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ABSTRACT
        A feasibility and planning study was conducted on
braille code problems in five areas. The areas were textbook format,
math and science, music notation, computer notation, and maps,
charts, and diagrams. Problems in each of the areas were identified
and defined by committees of experts. The problems were analysed and
a determination was made of the methodology and amount of time
required for their resolution. From the analyses it was concluded
that a massive, short-term research assault on all of the problems
was not feasible. However, a large number of problems were found
which could be resolved within three to four years. The basic
strategy for resolving these problems was group judgment or
consensus. The number of persons needed for the effort was three to
four. An application for a grant to study the problems was prepared.
(Author)

Braille Codes Pilot Project

1 December 1970 - 31 January 1972

Final Report

Grant No. 14-P-55094/4-01

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# Foreword

Much work needs to be done on problems within the braille codes for the blind person to fully realize his capabilities and potential. To this end the Braille Authority has worked tirelessly over the years. The Braille Authority is a group of persons distinguished in their knowledge of braille whose function, briefly, has been optimization of the use of the braille codes. A number of things, among them, the organization of the Authority, the part-time nature of its work, the shortage of financial resources, and the nature and magnitude of some of the problems have prevented this body from completely fulfilling its objective. As a consequence, this group initiated efforts to overcome this inadequate state of affairs and attack braille problems on a much larger scale. These efforts resulted in the present project. To obtain funds for the project the Braille Authority provided the background information and expertise, and Dr. Berthold Lowenfeld, chairman of the Advisory Council of the Braille Authority, prepared the application.

Not only was the work of the Braille Authority useful to the initiation of this project; it was also beneficial to the conduct of the investigation. In its efforts prior to the acquisition of this grant, the Braille Authority prepared an Outline of Research Needs for Improvement of the Braille Codes. This document covered a history of its work and a specification of important general problem types which confronted the Authority over the years. Because of the Authority's expertise and experience with the code problems, it seemed only reasonable that its work should assume a central part in the present project. As such, it constituted most of the introduction of this report, and, during the conduct of the investigation, it served as a very useful guide.

From the foregoing the impression should have been obtained that the present work was something more than an individual effort. It was. In its truest sense it was a group effort. As a group effort, it is difficult to express adequately appreciation to all of the persons who contributed and who were so very helpful to the study. But difficulty does not prevent the attempt. Sincere thanks are extended to the Braille Authority and its Advisory Council, to all of the working committees of the project, to those consulted who are too numerable to name, and to those who had to share the burden placed on the consultants and participants.

In saying that the project was a total group effort, it is not intended that the consultants should share any of the inadequacies of the study. Those who contributed were generous and knowledgeable in supplying the information requested of them. Any deficiencies or shortcomings in the outcome of the study are the sole responsibility of the authors.

CJK
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Contents

# Purpose

The purpose of this study was to explore the feasibility of a massive research program which would provide a coordinated solution to braille code problems in the areas of textbook formats and techniques; mathematics and science; music notation; computer notation; and maps, charts, and diagrams. Correlative to this objective, plans were to be made for future resolution of the problems. Planning was to take the form of determining the research strategy and amount of time needed to resolve the problems. An outcome of the study was to be a grant proposal for future work on the codes problems.

# Background

The history of tactual codes for the use of blind people in the United States is replete with numerous attempts to arrive at a reading system which would adequately present literature and technical material in a manner intelligible through the medium of touch. During the first 90 of the past 140 years, various educators for the blind advocated specific reading systems which varied from dot representations to raised ink-print letters. Some of the early systems used by individual schools and publishing houses for their own clientele of readers included Boston Line Letter, New York Point, Moon Type, American Braille, and Revised Braille Grade 1 1/2, which made published literature unavailable to those who were not trained in more than one embossed system. As a result of international conferences of representatives of English-speaking countries, the present basic system, Grade 2 Braille, was standardized in 1932. This system was based on the music notation and alphabet devised by Louis Braille and contained 185 contracted literary forms introduced into the system to accelerate reading.

In 1950, the American Association of Workers for the Blind(AAWB) and the Association for the Education of the Visually Handicapped (AEVH), then the American Association of Instructors of the Blind (AAIB), established a committee of braille experts to review the effectiveness of all braille codes in order to update them and to assure their adequacy in providing the media for the production of general literature, music, and technical materials. This committee, and its successors, have been organized on a voluntary basis with exceedingly limited funding provided by the two Associations.

The Braille Authority has produced several standard rule books to meet the specialized needs for embossing various types of ink-print representations. These include:

ENGLISH BRAILLE, AMERICAN EDITION 1959; Revised, 1962, 1966, 1968, 1970

THE CODE OF BRAILLE TEXTBOOK FORMATS AND TECHNIQUES, 1965; Revised, 1966, 1970

THE NEMETH CODE OF BRAILLE MATHEMATICS AND SCIENTIFIC NOTATION, 1952; Revised, 1965, 1972

THE REVISED INTERNATIONAL MANUAL OF BRAILLE MUSIC NOTATION, 1956

As these code books were given widespread use by braille publishers and educators of the blind, their effectiveness and value became readily evident. Prior to their development, only sparse amounts of technical material could be made available in embossed form, which resulted in limiting the education of blind people. As a specific example, some universities waived courses in mathematics and science for blind students who could not meet basic requirements because of the lack of adequate texts or embossed notations comparable to those being used by fellow students. As a result of the development of techniques for technical representation, even though substantially inadequate, parallel textbooks were made feasible, and the education of blind people expanded from the limitations of the residential schools for the blind to integration into community public school systems. This broadening of educational horizons has substantially expanded vocational opportunities for blind people in many areas, such as computer programming, social service, engineering, and teaching in mathematics, music, and the sciences generally.

In attempting to provide efficient and comprehensive braille codes for the various disciplines, the Braille Authority gathered together advisory committees of specialists and experts whose combined experience and knowledge have aided in producing needed symbols and techniques. Each code has required revision from time to time as information has been obtained by questions from educators and braille transcribers who were confronted with specific items not covered in published codes. No facilities or staff have, to date, been available to the Authority for systematic examination of all types of copy in order to search out and locate symbols and formats used by ink-print publishers. If braille codes are to be fully implemented, it is essential that researchers in all aspects of code development have an inventory of ink-print representations in order to provide for all possible braille code requirements. In addition, major work is yet necessary in the psychophysical investigation of tactile patterns, such as line, texture, and figure size, and so on.

With the passage of time, educators and braille publishers have been brought to the realization that volunteer braille committees, at their concentrated yet infrequent meetings, could not cope with all of the problems which occur in ink-print publications and represent them adequately in braille notation. In order to ensure equal educational and full vocational opportunities for blind people, it has become evident that a concentrated effort by braille specialists and experts must be undertaken. At the present rate of development, it is obvious that many years will pass before fully effective codes can be achieved under the existing method of operation. Therefore, the Braille Authority and its Advisory Council of 12 national representatives of workers for the blind are in agreement that complete braille code development can only be accomplished by definitive research on a full-time, paid basis, within a reasonable period of time. The following material describes the unfinished and gray areas of all of the specialized braille codes.

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## Needs in Specific Areas

Code of textbook formats and techniques    The great variety of transcription problems which occurs in textbook embossing have challenged the initiative of volunteer transcribers and braille publishers for many years and have resulted in techniques which likewise challenge the ability of the braille reader to comprehend the symbolism and rules of usage being followed.  In 1965, the Braille Authority and its Textbook Advisory Committee offered the first manual of techniques and format which has aided, to some extent, the standardization of presentation of this type of material.  In furnishing this guidance, the drafters were well aware that the material therein barely scratched the surface of the wide range of problems to be encountered in attempting an equivalent braille transcription of the many symbols and formats used in ink-print texts

Educators of blind children, youth, and adults have continued to pressure for a more inclusive and adequate manual of formats and techniques in order to give the blind student the equivalent information that his sighted peers receive   The problems have been compounded by the fact that authors and ink-print publishers have introduced visual techniques, such as the use of color, change of type, underscoring, etc , to point up differences in thought and emphasis   Additionally, the breadth and length of the ink-print page, as well as the size of type, provides ink-print publishers with a wide latitude of format, whereas the limitations of the braille page and the six-dot braille system necessitate readjustment and realignment of copy in order to make the presentation intelligible to the touch reader.  There-fore, problems of formats, diagrams, and tabulation require considerable research to make such material usable in embossed form

One of the major problems in dealing with formats is that, to date, it has not been possible to locate and identify all of the various types of usages which ink-print publishers employ   The problem is compounded by the fact that ink-print publishers themselves do not employ standard symbols for equivalent material   It is, therefore, essential that research be under-taken with regard to the practices of ink-print publishers in order that provision can be made for all ink-print symbols now in use

As a result of the material already provided in the CODE OF TEXT-BOOK FORMATS AND TECHNIQUES, ample evidence is at hand to insure that, with adequate funds and research personnel available, the blind student can be given the facilities to meet his educational demands on an equal basis with his sighted peers.

Maps, charts, and diagrams   A review of current procedures and resulting products of braille paper maps, diagrams, and charts shows that there have been no changes or improvements since the early 1930's, with the possible exception of employment of the vacuum-forming process, which can take advantage of other techniques not practical for the two-dimensional limitations of paper reproduction   Further, no basic research on the psycho-physical problems of the braille reader has been undertaken except on a very limited scale (see Nolan & Morris, 1971)   The problems in this field are, therefore, in need of an unusually large amount of research, covering not only

the psychophysical aspects, but the determination of legible symbols and usages, and the development of the tools to make such maps, charts, and diagrams--both by the hand transcriber who works directly on paper and the publisher of multiple-copy materials who must work on the same metal sheet used for embossing braille books  The problems are further aggravated by the fact that, not only is there no standardization of symbols used, nor tools to make them, but no attempt has been made in the educational field to develop adequate procedures for teaching the reading of braille maps, charts, and diagrams.  Any research undertaken, therefore, must include not only the development of braille symbols (including dot and line sizes and kinds) and the creation of the tools to make them, but the development of procedures for teaching the reading of such materials to the blind student and the finding of some way of having such information included in the curricula of colleges and universities conducting special education courses for teachers of the blind

Music  The esthetic and economic value of music in broadening the cultural life and in providing employment opportunities for blind people is axiomatic  THE REVISED INTERNATIONAL MANUAL OF BRAILLE MUSIC NOTATION, 1956, offers the basis for a workable, yet far from complete, system of notation which meets the minimal needs of the music student and performer  Provision already exists for vocal and instrumental notation which, in general, is systematically adequate  However, gaps still exist for the presentation of more complex scores and performing techniques, such as for liturgical music (Gregorian and Anglican chants), the tonic sol-fa notation, and certain percussion, string, and wind instruments, not to mention the growing number of electronic devices being used in modern music.

The existing music code provides for optional techniques in presenting many musical passages which leads to the confusion of the trans-criber as well as interpretation by the performer.  This confusion has resulted in a diminishing number of volunteer music transcribers, and the almost impossible problem of developing a computer program for braille music embossing. Through research, it is hoped that many of the vagaries and inconsistencies can be eliminated, and thus make music scores more intelligible to students, performers, and transcribers.

Serious study must also be undertaken to compare music presenta-tions by various ink-print publishers in order to coordinate and correlate all techniques in common or unusual use

Mathematics and scientific notation.  The importance of a knowledge of mathematics in the education of blind people is increasingly evident in view of the many opportunities for employment which such knowledge can provide. Blind men and women are presently finding open doors in the fields of mathematics instruction, tax advising, actuarial work, computer programming, engineering, and the hard sciences, all of which have been made possible through the availability of appropriate mathematics symbolisms and techniques.  The current mathematics code is but a foundation to the broad range of mathematics and scientific notation which is required to handle common usages and now symbols and formats in the developing world of scientific endeavor.  To ensure that the mathematics code is fully adequate and current, it is essential that a wide investigation of all applicable fields be made by research teams

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to the end that vocational opportunities can be made available in every
scientific field. Although almost all of the symbols currently being
used in science and mathematics are provided for in the current Nemeth
Code, additional symbols will be required for those used in the developing
sciences. Much research is yet required to find the most effective techniques
for the presentation of certain ink-print formats; algorithms, tabular material,
and the like. Additionally, information is yet barely provided concerning
the presentation of statistics and logic.

Computer notation. Since symbols and formats for computer codes
vary to some degree from usual mathematical presentation, it is essential
that a special team of researchers be engaged in seeking out and developing
the necessary braille code for this discipline. Such items as flow charts
and punchcard information require attention. Additionally, it is essential
that coding systems for developing hardware and software be provided to
keep manuals up-to-date.


Procedure

To fulfill the purposes of the study, information was needed
about the number and types of existing braille problems and the methodology
and time periods required to resolve the problems. In order to acquire this
information, it was necessary to identify and define as many of the problems
as possible. To accomplish this committees of experts were formed for each of
the five areas of interest. Subsequent to their work the project staff
analysed the problems and determined the methods and the amount of resolution
time required. A final review group made up of the Braille Authority and its
Advisory Council evaluated the work of the project staff. Their conclusions
provided the basis for the final wrap-up of the study.

The composition of each of the working committees in each of the
five areas was based on a number of criteria. (1) All had to be knowledgeable
in braille and their respective areas. (2) One or more had to be teachers.
(3) One or more had to be a volunteer transcriber. (4) One was to be
employed by a publishing house. And (5), where possible, all were to be
members of the Braille Authority Advisory committees. Selection of the com-
mittee personnel was done with the aid of recommendations from members of
the Braille Authority and other accomplished persons in the area of the
visually handicapped. Final membership on a committee depended on the number
of the candidate's recommendations and his willingness to serve on an
unpaid basis. A listing of the members of each comittee can be found in
Appendix A.

There were two, two-day meetings of each of the working committees
in each of the areas. The two meetings in each of the areas were separated
by approximately two and one-half months. During the first meeting the
committees identified and discussed braille code problems about which they
were knowledgeable. Afterward the investigator refined and classified the
problems by type. Prior to the second meeting this refined list of the
problems was sent to the members of the appropriate committees. At the
second meeting, the committees reviewed and evaluated the work-up of the

investigator and modified and expanded the materials where necessary.
Following this meeting, the problem lists were revised to conform to the
changes and additions suggested by the committees

Next, the individual lists were evaluated to determine similar
kinds of problems common to all the areas, and all of the problems were
brought together in a generalized list. Using the generalized list,
analyses were made of the different types of problems and of the kinds
of research work necessary to resolve the problems. Two reviewers
independently performed this latter activity. A tabulation of these results
provided the bases for the preliminary conclusions of the study. The gen-
eralized problem list and the conclusions were sent to the review committee
for its evaluation. The review committee was composed of the Braille
Authority and its Advisory Council. A listing of the members of these groups
appears in Appendix B. A two-day meeting of these groups was held to discuss
the results and preliminary conclusions of the study. Subsequent to the
meeting, a report of its proceedings was written and further analyses suggested
by the review groups were made of the data

Results

The results section, while not presented in two separate parts,
was in fact developed at two different times and under different conditions.
The first part consisted of the first two tables of data and provided the
bases for the preliminary conclusions of the project. The second part consisted
of the remaining tables of data and was the result of analyses requested by
the Advisory Committee. These data were the bases for the final conclusions.
Basically, the two parts differ in degree of differentiation and reflectance
on future work. The second part is the more specific and is concerned with
the details of follow-up work.

The basic results consisted of five lists of problems which were
identified by the five working committees. The problems generated by the
committees were analysed and it was found that, with the exception of the
maps, charts, and diagrams area, they were classifiable under one of five
headings: (1) general considerations, (2) problems of symbology, (3) problems
of format, (4) problems of displays, and (5) factors needing development.
A sixth class of information, resources, was added to some of the areas where
it appeared useful to follow-up work. The maps, charts, and diagrams problems
were of slightly different types. All of these problems can be found listed
by areas in Appendix C

A second kind of analysis necessary to judgments of feasibility
and subsequent work on the codes consisted of relating the problems across
areas. This meant bringing together the same kinds of problems from all
of the areas. The outcome of this endeavor was a more complete and refined
classification of a generalized list of problems. This generalized list
can be found in Appendix D

A gross analysis of the problems identified the kinds of approaches
needed to resolve them. Three categories of problems were found: (1) problems
that could be resolved by expert group consensus or judgment (GJ), (2) problems

involving experimental or empirical research (ER), and (3) problems involving code development (CD). This evaluation led to a third kind of results consisting of identification of the strategies for resolving the problems and estimates of the time required to implement the strategies. The remainder of the results section will concern these data.

Two persons independently evaluated the problems for methodologies and time estimates. The basic methods for which the problems were evaluated were those found above and their combinations. The time estimates were (1) short-term activity of less than three years or (2) long-term activity of more than three years. The degree of agreement between the two reviewers was approximately 90% or the equivalent of a .95 correlation.

One of the reviewers in his evaluation elaborated the methods to include literature analysis (LA), which was either a review of print or braille literature or a frequency count of some of the elements of the language, and an attitude or opinion survey (OS). Because of its greater differentiation this analysis was the one used for reduction of the data in tables 1 and 2. The item analysis by the two reviewers can be found in Appendix E.

Table 1 shows a frequency count of the methods and time estimates for the different types of problems. The entries and total number represent individual problems from four of the areas. excluding the maps, charts, and diagrams area. This category was excluded because the problems were mainly of a perceptual nature requiring basic research over a long duration. The total number of these perceptual problems was approximately 160.

The entries in Table 1 show there were 678 problems in all. Again, this is exclusive of the non-linear display problems which, in terms of experimental efforts, would undoubtedly exceed that required by the problems listed. With regard to the total number, the figure should be considered only as approximate because a number of the items contained more than one problem or consideration.

In terms of types of problems, the linear display category contained the most, approximately 31%. The second most frequent was formats for page variations with 21%. Following this were the general considerations with 18%. The next most numerous, at 13%, were the problems of symbols and rules. The other three categories, factors needing development, formats for language and special materials, and formats for parts of book, made up the remaining 17%.

In terms of the methodology or approaches for resolving the problems, data in Table 1 were combined and placed in Table 2. The data were combined to indicate better the basic methods and times estimates which reflect on the nature and direction of the work required.

Table 1

Approaches and Time Estimates for Resolving the Generalized Problem Items from the Standpoint of Their Occurrence in All of the Areas

| Problem Types | GJ 1 | GJ 2 | GJER 1 | GJER 2 | GJOS 1 | GJOS 2 | GJLA 1 | GJLA 2 | GJCD 1 | GJCD 2 | ER 1 | ER 2 | ERLA 1 | ERLA 2 | EROS 1 | EROS 2 | CD 1 | CD 2 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| General considerations | 66 | 8 | 12 | 2 | 6 | | 14 | | 2 | | 1 | 12 | 1 | | | | | 1 | 125 |
| Problems of symbols and rules | 39 | | 12 | 2 | 5 | | 12 | | 9 | | 11 | | | | | | | | 90 |
| Formats for parts of book | 7 | | 5 | | 2 | | 1 | | | | 1 | | | | 2 | | | | 18 |
| Formats for page variations | 29 | | 46 | | 5 | | 36 | | | | 13 | | 3 | | 5 | | | | 142 |
| Formats for language and special material | 27 | | 6 | | 2 | | 8 | | | | 1 | | | | | | | | 44 |
| Linear displays | 22 | | 87 | 8 | 3 | | 17 | | | | 38 | 9 | 23 | | 2 | | | | 209 |
| Factors needing development | 27 | | 2 | 1 | 1 | | | 1 | 6 | | 3 | | | | | | | 9 | 50 |
| Totals | 217 | 8 | 170 | 13 | 24 | - | 88 | - | 17 | - | 68 | 21 | 32 | - | 9 | - | - | 10 | 678 |

Table 2

Combined Approaches and Time Estimates for
Resolving the Problems in All of the Areas

| Problem Types | GJ 1 | GJ 2 | GJ+ 1 | GJ+ 2 | ER+ 1 | ER+ 2 | CD 1 | CD 2 | Totals |
|---|---|---|---|---|---|---|---|---|---|
| General considerations | 66 | 8 | 32 | 2 | 2 | 12 | 2 | 1 | 125 |
| Problems of symbols and rules | 39 | | 29 | 2 | 11 | | 9 | | 90 |
| Formats for parts of book | 7 | | 8 | | 3 | | | | 18 |
| Formats for page variations | 29 | | 87 | | 26 | | | | 142 |
| Formats for language and special material | 27 | | 16 | | 1 | | | | 44 |
| Linear displays | 22 | | 107 | 8 | 63 | 9 | | | 209 |
| Factors needing development | 27 | | 3 | 2 | 3 | | 6 | 9 | 50 |
| Totals | 217 | 8 | 282 | 14 | 109 | 21 | 17 | 10 | 678 |

Table 2 showed that the proportional distribution of short- and
long-term efforts varied considerably among the approaches and problem types.
A cursory addition of the totals for the approaches indicated that more
than 600 required short-term efforts. The method which occurred with the
greatest frequency, 44% was the combination group judgment plus other
research-like activities. This category along with the straight group
judgment category contained 77% of the problems. Of this 77% only 4%
require long-term solutions. The third most numerous category was ex-
perimental research with 19% of the problems, of which 16% were long-term.
Code development made-up the remaining 4% of the problems. Thirty-seven
percent of these were long-term.

The preceding two tables of data formed the basis for the preliminary conclusions which were reviewed by the Braille Authority and its Advisory Council. These groups recommended that other counts and analyses be made of the data. The tables and data which follow are an implementation of this recommendation.

One of the items requested by the groups was a count of the actual number of separate problems contained in the generalized list of problems across areas. This number was 455 as contrasted with the 678 individual problems in all of the areas. Table 3 shows the total number of problems agreed upon by the two reviewers, 409. This number divided by the total, 455, gave the 90% agreement between the two reviewers. Except for the fewer number of problems, this table is similar to Table 1. Moreover, it reflects essentially the same information as the earlier table.

Another kind of analysis wanted by the groups was a more definitive breakdown of the short-term, group judgment problems. The breakdown was to contain data useful in determining the duration of approaches and problem priorities.

Table 4 presents these data classified by areas and types of problems. It showed that the textbook format area contained 46% of the problems, the music area 29%, and the math area 20%. The remaining 5% were found in the computer and map areas.

Concerning the types of problems, the data indicated the following. Most of the general considerations problems were, in fact, non-specific to the individual areas. An examination of these problems showed they were mostly matters of policy and philosophy of transcription. Among the other types of problems, excepting formats for parts of book, the frequency of occurrence was fairly uniform. The problems, formats for parts of book, occurred with much less frequency than the other types. Two of the problem types, formats for parts of book and formats for language and special materials, occurred only within the textbook format area.

Table 5 presents a more precise breakdown of the time required to solve the different types of short-term, group judgment problems. The data were fairly straightforward and showed that 82% of the problems could be resolved in one year or less, 14% could be resolved in one to two years, and only 4% required two to three years.

Table 6 presents a more refined breakdown of the time required to resolve the short-term, group judgment problems which required additional work. As in Table 5 most of the problems, 79%, could be resolved in one year or less, 14% in one to two years, and 7% in two to three years. Table 6 also shows that the problem types, problems of symbols and rules, formats for parts of book, formats for page variations, and formats for language and special materials, require, almost exclusively, only one year or less to resolve.

Table 3

Approaches and Time Estimates Agreed Upon by Two Reviewers for
Resolving the Separate Generalized Problem Items

| Problem Types | GJ | | GJER | | GJOS | | GJLA | | GJCD | | ER | | ERLA | | EROS | | CD | | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | |
| General considerations | 35 | 7 | 9 | 10 | 7 | | 9 | 1 | 3 | 1 | | 12 | | | | | | 2 | 96 |
| Problems of symbols and rules | 13 | | 5 | 1 | 1 | | 8 | 1 | | | | 2 | | | | | | | 31 |
| Formats for parts of book | 7 | | 4 | | 2 | | 1 | | | | 1 | | | | | | | | 17 |
| Formats for page variations | 25 | | 26 | | 4 | | 21 | | | | 7 | | 2 | | 4 | | | | 89 |
| Formats for language and special material | 22 | | 6 | 6 | 2 | | 6 | | | 1 | | | | | | | | | 37 |
| Linear displays | 18 | 1 | 50 | 2 | 2 | | 5 | 1 | | | 7 | 5 | 3 | | 1 | | | | 99 |
| Factors needing development | 26 | | 1 | | 1 | | | | 5 | 1 | 3 | | | | | | 1 | | 40 |
| Totals | 146 | 8 | 101 | 19 | 19 | | 50 | 3 | 8 | 3 | 18 | 19 | 5 | | 7 | | 3 | 3 | 409 |

Table 4

Short-Term, Group Judgment Problems Agreed Upon by Both Reviewers Which Show the Relationships between the Separate Generalized Problems and Their Referents in the Five Areas

| Problem Types | No. Separate Problems | Areas | | | | | Total Problems in Five Areas |
|---|---|---|---|---|---|---|---|
| | | TF | Math | Music | Comp. | Maps | |
| General considerations | 35* | 1 | 3 | 6 | 4 | 1 | 15 |
| Problems of symbols and rules | 13 | 9 | 7 | 10 | 2 | | 28 |
| Formats for parts of book | 7 | 7 | | | | | 7 |
| Formats for page variations | 25 | 16 | 6 | 6 | 1 | | 29 |
| Formats for language and special material | 22 | 22 | | | | | 22 |
| Linear displays | 18 | 11 | 13 | | | | 24 |
| Factors needing development | 26 | 4 | 1 | 22 | | | 27 |
| Totals | 146 | 70 | 30 | 44 | 7 | 1 | 152 |

* Mostly matters of policy

Table 5

Refined Resolution-Time Classification of the
Short-Term, Group Judgment Problems

| Problem Types | Time | | |
|---|---|---|---|
| | One Year or Less | One to Two Years | Two to Three Years |
| General considerations | 27* | 4 | 4 |
| Problems of symbols and rules | 10 | 3 | |
| Formats for parts of book | 5 | 2 | |
| Formats for page variations | 22 | 2 | 1 |
| Formats for language and special materials | 22 | 2 | |
| Linear displays | 16 | 2 | |
| Factors needing development | 18 | 7 | 1 |
| Totals | 120 | 20 | 6 |

* Mostly matters of policy

Table 6

Refined Resolution-Time Classification of the Short-Term
Group Judgment Problems Which Require Additional Work

| Problem Types | GJER | | | GJLA | | | GJOS | | | GJCD | | | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Years | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| General considerations | 4 | 4 | 1 | 6 | 2 | 1 | 5 | | 2 | | 1 | 2 | 28 |
| Problems of symbols and rules | 4 | | 1 | 7 | 1 | | 1 | | | | | | 14 |
| Formats for parts of book | 4 | | | 1 | | | 2 | | | | | | 7 |
| Formats for page variations | 25 | | 1 | 21 | | 1 | 4 | | | | | | 51 |
| Formats for language and special materials | 5 | 1 | | 5 | 1 | | 2 | | | | | | 14 |
| Linear displays | 40 | 8 | 2 | 2 | 2 | 1 | 1 | 1 | | | | | 57 |
| Factors needing development | 1 | | | | | | 1 | 1 | | 4 | | 1 | 7 |
| Totals | 83 | 13 | 5 | 42 | 6 | 2 | 16 | 1 | 2 | | 5 | 3 | 178 |

In order to make these times meaningful in terms of manpower needed, the data in tables 5 and 6 were further evaluated for number of man-years required   This analysis assumed that the necessary manpower would be assisted by groups of persons expert in the problems being considered.  For the data in Table 5 it was decided that all of the one year or less problems could be resolved by one person in one year   The other problems in that table would take one person approximately three years    From Table 6, figuring six weeks for each of the one year GJER items and four weeks for each of the one year GJLA items resulted in approximately 10 and 3 man-years, respectively. The other items in these categories and in the two other categories, GJOS and GJCD, would require one person three years for each kind   The total figures for each of the different types of problems can be found in Table 7. Altogether they amounted to 29 man-years.

Because the large number of short-term problems required such an extensive amount of work, priorities for attacking the problems were needed.

Table 7

Number of Man-Years Required by the Different
Short-Term, Group Judgment Problems

| GJ | GJER | GJLA | GJOS | GJCD | Total |
|----|------|------|------|------|-------|
| 4 | 13 | 6 | 3 | 3 | 29 |

Priorities needed to be established for the solution of the greatest number of problems within the shortest period of time   An examination of the tables indicated this objective could be realized by selecting the problems which (1) involved group judgment, (2) appeared in the fewest number of areas, (3) involved the least number of approaches and (4) required the fewer number of long-term efforts   Four types of problems appeared to fit these criteria. Their presentation order indicates the order in which they should be studied.

a)  Formats for Language and Special Materials
b)  Formats for Parts of Book
c)  Problems of Symbols and Rules
d)  Formats for Page Variations

In order to determine the amount of time required to resolve only these four types of problems, Table 8 was prepared   This table is merely an amalgam of the data on the four types of problems found in previous tables.

It shows the four types of problems classified by methodology and refined solution times. In all there were 151 problems. Forty-three percent were GJ, 26% were GJER, 24% were GJLA, and 6% were GJOS. There were no GJCD problems. Ninety-two percent of all the problems could be resolved in one year or less given the sufficient manpower

To determine the manpower needs for these data calculations similar to those performed for Table 7 were made. The calculations indicated the one year GJER problems would require four and one-half man-years, and the one year GJLA problems would require approximately three and one-half years. All the rest of the problems would require around three man-years. The total for the four categories of problems was approximately 11 man-years.

Table 8

Resolution-Time Estimates for Four Categories of Problems

| Problem Types | GJ | | | GJER | | | GJLA | | | GJOS | | | GJCD | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Formats for language and special materials | 22 | | | 5 | 1 | | 5 | 1 | | 2 | | | | | |
| Formats for parts of books | 5 | 2 | | 4 | | | 1 | | | 2 | | | | | |
| Problems of symbols and rules | 10 | 3 | | 4 | | 1 | 7 | 1 | | 1 | | | | | |
| Formats for page variations | 22 | 2 | | 25 | | 1 | 21 | | | 4 | | | | | |
| Totals | 59 | 7 | | 38 | 1 | 2 | 34 | 2 | | 9 | | | | | |

## Conclusions

The conclusions are described in three parts. The first part deals with the preliminary conclusions which were prepared for and reviewed in the final evaluation meeting. The second part is the report of the deliberations and conclusions of the evaluative groups. The third part contains conclusions based on further analyses suggested by the evaluative groups as well as other final considerations dictated by the study.

### Preliminary Conclusions

These conclusions were derived from the generalized problem summary and the tabulated results. They were of three types: (1) those concerned with transcription policy and background, (2) those concerned with the results of the classification of methods and time, and (3) those concerned with future work on the codes.

Some of the conclusions were based on an examination of the items in the problem summary. One problem of considerable importance which arose in a number of the areas had to do with the development of an overall code which would embrace all the areas. It was suggested that characters used in such a code might be three dots high with a variable base, i.e., a character could be 2, 3, 4, or more dots wide. Such a system would permit thousands of symbols to be distinctly coded. This system will subsequently be called an integrated code. Obviously such a consideration would have far-reaching consequences, and the project staff needed guidance from the evaluative groups before making final conclusions.

The preliminary conclusions will be listed by number as they were for the evaluative committee.

1) There are some relatively basic issues and policy matters contained in the general considerations section of the report, e.g., inconsistencies and ambiguities within and across codes or the issue of isomorphism versus divergence. These issues need to be resolved at the very beginning of any future work on the codes.

2) Before any long-term research efforts are begun the question of whether or not to develop an integrated code should be resolved.

3) A massive, short-term (three-four years) research assault on all of the problems of the braille codes is not a feasible approach. For one reason, there are too many problems. For another, the study and solution of many problems is sequential in nature and must of consequence be spread over a number of years.

4) Because of the long-term, sequential nature of a large number of the problems, the code work must necessarily be of a developing character resulting in successive approximations to the most readable code. Furthermore, since language and new information are constantly evolving, code development and research will probably never cease.

5) There are a large number of problems that can be solved through expert discussion and agreement within a relatively short time. Work involving the judgment of groups of experts could be initiated immediately and with a sufficient number of personnel most of these problems could be resolved in approximately three years.

6) In order for any long-term research program to be initiated and successfully carried out, a responsible organization must be set up or identified from existing organizations.

## Summary of the Review of the Project by the Sponsoring Groups

The conclusions listed on the previous pages were reviewed and their implications discussed at a joint meeting of the Braille Authority, its Advisory Council, and the project staff held at the American Printing House for the Blind (APH) on 20-21 January 1972. Those present were Mr. Bernard M. Krebs, Mrs. Maxine Dorf, Miss Marjorie S. Hooper, Mrs. F. J. Mann, of the Braille Authority; Dr. Berthold Lowenfeld, Dr. Natalie C. Barraga, Mr. Robert S. Bray, Dr. Charles E Hallenbeck, Dr. Robert W. Mann, Miss Lorraine P. Murin, Dr. Abraham Nemeth, Dr. Carson Y. Nolan, Miss Josephine L. Taylor, of the Advisory Council; and Mr. Finis Davis, Vice President and General Manager of APH. The meeting started with a description of the procedures used in the study, a review of the findings, and of the conclusions drawn by the principal investigator. The principal investigator then presented the group with the following list of questions for possible discussion.

1. Are the conclusions warranted and do you agree with them?

2. If there is agreement, what should be done about resolution of the problems? Specifically,

    (a) Should the development of an integrated code be considered? Should a feasibility study of the integrated code be formulated?
    (b) What are the implications of studying the integrated code on the resolution of the short-term problems by groups of experts? Should a research program be developed for these short-term problems?

3. If a research program is set up for studying either or both the integrated code and the group judgment problems, what should be done about the following?

    (a) How should the program be organized and administered?
    (b) Over how long a period of time should the program extend?
    (c) How should the program be staffed?
    (d) Where should the staff and facilities be housed or located?
    (e) Who could sponsor or fund the program?
    (f) What role should be played by various organizations involved in work for the visually handicapped? Mr. M. Robert Barnett expressed interest in how the American Foundation for the Blind (AFB) could help or contribute to the project and future code work.

4. What further analysis should be done to the data?

5. Are there any other items of interest or concern in the problem summary, classification of methods, or the overall project which should be discussed?

Agreement with the conclusions  While there was considerable discussion and a number of questions raised concerning certain aspects of the conclusions, in general the group agreed with the project staff's appraisal of the meaning of the results of the study. The project staff was requested to attempt a more detailed breakdown of the data than was available in Table 1. What the group wanted was an actual count of the problems in the generalized problem list and more definitive time estimates of the short-term problems. It was felt that this additional information would be quite valuable in the assignment of priorities and the estimation of future project costs.

Future research efforts  The group agreed that a broad scale research effort to resolve braille problems should be mounted. Immediately, an intensive attack should be made on the short-term problems of the present codes that were judged solvable through group concensus. Concurrently, an attempt should be made to explore the possibilities for long-term development of an integrated code and to develop resources for research on the perceptual problems involved in non-linear tactile displays.

Overall stimulation and monitoring of the research.  It was agreed that all research should take place under the umbrella of the Braille Authority and its Advisory Council since a continuing body was needed for this purpose. The possibility of combining the membership of both these groups into an American Braille Council (ABC) for this purpose was discussed. It was suggested that the National Braille Association might also be included in the ABC membership. It was agreed to explore the formation of the ABC with the sponsoring bodies of the Braille Authority, the AEVH, and the AAWB.

Development of an integrated code.  The group discussed the potential of an effort to develop an integrated code which would cover all the areas; literary, mathematics, science, music, and computer notation. The latter specific codes would all be subsets of a whole. An integrated code would require that each construct be represented the same way in braille regardless of subject matter.

The group felt that development of an integrated code should be thoroughly explored. It was agreed that the most fruitful approach was use of a variable base cell, three dots high. If three columns were ultimately used this would yield 512 possible configurations, or if four columns were used, 4096 different configurations would be possible. The group was in agreement that an expanded code of this nature could retain most of the elements and meanings of the current literary code. The code should be compatible for computer translation.

The agreement of the group to pursue this investigation was made in full understanding of the many problems that would insue from a major code change. Problems discussed included the facts that all of the current codes, excepting the literary, would be rendered obsolete, current manuals would have to be rewritten, the braille consumer would be faced with the necessity for considerable relearning of codes, this country would be out of step with the rest of the world, and present writing devices and embossing equipment would have to be redesigned.

It was believed that some of the initial feasibility studies should concern cell legibility. It was pointed out that while an expandable cell offered greatly increased possibilities for diverse braille characters, it was not known at what degree of expansion perceptual problems might occur. Successful outcomes of the cell legibility studies would lead to work on the integrated code. This latter task was perceived as quite a long-term activity.

Sites for the feasibility studies were discussed. APH personnel expressed a low level of interest in this research. It was agreed that the best site might be a university based department of psychology. Discussion of possible sources of funding for these activities pointed up the severity of the problem of finding adequate funding for research of this nature under present conditions. Private organizations were considered the better possibilities.

Resolution of short-term problems by groups of experts. One major finding of the study was that there appeared to be a very large group of problems which could be resolved in a relatively short time through expert consensus. This is the traditional method of code development and definition followed by the Braille Authority through use of its subject matter oriented committees. The group was in agreement that efforts should be made to organize an intensive effort to solve these problems. Research funds should be sought to support a central site for such development and to pay expenses and honoraria to experts. It was felt this work should start immediately.

The present list of problems would need further breakdown and specification before this could occur. It was stressed that expert groups participating in the program should represent all braille users, young and old consumers, educators, volunteers, publishers, code experts, and subject matter experts. Where necessary group judgment should be validated through short-term perceptual research.

Site and organization for the short-term research. A number of possible sites for locating the short-term research effort were discussed. It was ultimately decided that this should be based at APH. This decision was strongly influenced by APH's role as the nation's official supplier of textbook braille, its continuous program of research, and its previous involvement in the solution of these kinds of problems.

It was suggested that APH write a proposal to obtain funding for the research. The general plan for the research was that it would consist of a strong intensification of the methods used by the Braille Authority

over the past decades in that groups of experts would be set up to deal
with narrow problem areas   APH would provide a small staff to include
a project director and assistants as well as space to house this staff
and provide for small group meetings   The task would be to organize,
schedule, monitor, and guide the small expert groups as they attacked
problems in their areas   Outcomes would be assessed and integrated across
code areas   Where necessary other APH research staff might provide short-term
perceptual research support to validate small group decisions.

Funding of the short-term research   Among possible funding sources
discussed were government agencies such as U S  Office of Education,
Library of Congress, National Eye Institute, and Social and Rehabilitation
Service and private agencies such as the Seeing Eye Foundation and AFB.
It was thought that APH's proposal should be initially submitted to Social
and Rehabilitation Service for a three to four year project.

The need for intermediate funding to support the Braille Authority
and its Advisory Council as well as any interim research they might conduct
was raised   Dr  Lowenfeld and Mr  Bray agreed to approach the AFB in this
regard with the Seeing Eye Foundation held as a possible alternate.  These
funds could also be used to finance activities of the ABC if brought into
being   It was estimated that $20-24,000 would be required for one year
of interim support

Special legislation as a source of funding   The group explored the
possibilities of attaining special federal legislation to provide funds for
braille code research as well as research in other areas   In response to
group queries, Mr  Davis of APH agreed that this was a distinct possibility,
but strongly urged that such efforts do not interfere with administration
of the present "Act to Promote the Education of the Blind."  At the urging
of the group, Mr  Davis agreed to explore the question of legislation with
the Board of Trustees of APH and report the results of this exploration to
Dr. Lowenfeld.

Research on non-linear displays   It was agreed that non-linear
displays such as maps, charts, and diagrams present a special research
problem.  Little is known about basic processes involved in their perception
Knowledge of these processes is critical for development of improved designs
which will be maximally legible   Research in this area must of necessity
be long-term because the range of problems is broad and many solutions must
be sequential in nature

The group stongly urged increased research efforts in this area
Dr  Nolan and other group members reported their failure to interest uni-
versity based psychologists and others in this research area   It was
reported that APH had the only full time longitudinal program of this kind
consisting of 1 5 persons   The group urged this effort be expanded.

The problem of funding basic tactile research was discussed   It
was commented that requests for funding this kind of research often falls
between "cracks" in the granting programs of federal agencies   Private
agencies were suggested as the best source of funds for this purpose

## Final Conslusions

The final conclusions were principally concerned with the implementation of the recommendations of the advisory groups concerning future work on the short-term, group judgment and related problems. Specifically, the advisory groups recommended that immediate efforts be made to procure funds for resolving these problems. To do this, more information was required about problem priorities and estimates of time and personnel needed. Information relevant to these factors can be found in tables 4 through 8. Conclusions based on these data were the foll wing.

1) There were four categories of problems where work could be started immediately. They were:

a) Formats for Language and Special Materials
b) Formats for Parts of Book
c) Problems of Symbols and Rules
d) Formats for Page Variations

Their arrangement from top to bottom represents the order in which the problems should be attacked. Work on the other categories of problems would yield less immediate results. However, these other problems should not be ignored completely, but should be evaluated within the categories for priorities of individual items. This would be especially true of the general considerations category which contains matters of policy and philosophy of transcription which should be evaluated at the outset.

2) There were three areas where most of the short-term, group judgment problems were found -- textbook format, music, and mathematics. This was also true of the problems solvable by the other methods. Hence, future work should include a specialist from each of these areas.

3) It was estimated that work on the four categories of problems would require approximately 11 man-years. Using three people, one from each of the areas mentioned in item two, would mean that these problems could be resolved in approximately three and one-half years.

These conclusions will provide the bases for an application for funds to pursue the resolution of the problems which are short-term and have the more immediate payoff. This means the work begun in the Braille Codes Pilot Project could be continued without much loss of time. It does not mean that the other more long-term problems would be ignored. They simply require more resources and structure than what can be provided within a reasonable period of time. Moreover, if work is begun on the short-term problems, part of the efforts of those involved can be devoted to planning and seeking the resources necessary for the long-term problems.

One of the grave difficulties confronting work on the long-term problems is the absence of reliable information about the sense of touch or tactual perception. In the late 19th century Wilhelm Wundt studied the perception of dot configurations and determined that the braille cell was optimum in terms of number and form (Burklen, 1932). Since that time, over 100 years ago, very little additional information about the touch reading

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process has accumulated which would permit principles and standards to
be established for the production and reading of tactual materials.
Thus, it cannot be expected that all of the problems of the braille codes
are going to be resolved in a short time simply as a result of the appli-
cation of a large amount of money. Needed are the interest and capabilities
for doing tactual perceptual research.

## Summary

A feasibility and planning study was conducted on braille code
problems in five areas. The areas were textbook format, math and science,
music notation, computer notation, and maps, charts, and diagrams. Pro-
blems in each of the areas were identified and defined by committees of
experts. The problems were analysed and a determination was made of the
methodology and amount of time required for their resolution. From the
analyses it was concluded that a massive, short-term research asault on
all of the problems was not feasible. However, a large number of problems
were found which could be resolved within three to four years. The basic
strategy for resolving these problems was group judgment or consensus.
The number of persons needed for the effort was three to four. An
application for a grant to study these problems was prepared.

Bibliography

An outline of research needs for the improvement of the braille codes.
    Unpublished manuscript, AAIB-AEVH Braille Authority, 1969.

Bürklen, K.  Touch reading of the blind.  New York:  American Foundation
    for the Blind, 1932.

The code of braille textbook formats and techniques, 1965.  (Rev. 1970)
    Louisville, Ky.:  American Printing House for the Blind, 1971.

English braille, American edition, 1959.  (Rev. 1970)  Louisville, Ky.:
    American Printing House for the Blind, 1971.

The Nemeth Code of braille mathematics and scientific notation, 1965.
    Louisville, Ky.:  American Printing House for the Blind, 1966.

Nolan, C. Y., & Morris, J. E.  Improvement of tactual symbols for blind
    children:  Final report.  Louisville, Ky.:  American Printing
    House for the Blind, 1971.

Revised international manual of braille music notation, 1956.  (American
    ed.)  Louisville, Ky.:  American Printing House for the Blind,
    1961.


For Reviews of Braille Research:

Lowenfeld, B., Abel, G. L. & Hatlen, P. H.  Blind children learn to read.
    Springfield, Ill.: Charles C. Thomas, 1969.

Nolan, C. Y., & Kederis, C. J.  Perceptual factors in braille word
    recognition.  American Foundation for the Blind, Research Series,
    1969, No. 20.

Umsted, R. G. Improvement of braille reading through code recognition
    training.  Unpublished doctoral dissertation, George Peabody
    College for Teachers, 1970.


For Braille Research Bibliography:

Kederis, C. J., Nolan, C. Y., & Morris, J. E.  Bibliography of
    reserach on braille  Louisville, Ky.:  American Printing House
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## Appendix A

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Appendix C

Reports of Committee Endeavors in Each of the Areas.

Braille Codes Pilot Project

Outcome of Endeavors of Textbook Committee


I.  General Considerations

A.  Format

1.  Problems in the textbook area revolve primarily around format practices and rules.

2.  Editing is principally a format problem, and editors and transcribers vary in their knowledge of the code and their practices of formatting.

a)  This variation is also true of teachers and hence educational factors or considerations become involved

b)  Should copy be rearranged or in other ways modified for reasons of logic, organization, or other meaningful considerations.  Under what conditions could the copy be altered

3.  Format techniques and rules should be looked upon only as guidelines which may change with future developments.

a)  Practices and rules should be kept current with changing print practices.

b)  Maintaining currentness is an ongoing process and requires continuous monitoring of print and liaison with print publishers.

c)  An attempt should be made to determine the tactual meaningfulness of changing print practices.

d)  American Printing House for the Blind has recently completed a 1970 addendum to the Code of Textbook Formats and Techniques.

B.  Considerations involving the examination and evaluation of the practices and rules of the present literary and textbook code.

1.  Some of the symbolism may be deleted but new meanings should not be assigned to the characters formerly used.

2.  An effort should be made to eliminate inconsistencies within and across codes, e.g. those found among certain contractions whose use is dependent upon syllable division and/or pronunciation, and those for which different characters have the same meaning or vice versa.

3. Consider the resolution of difficulties caused by requiring the young child to learn different forms of the same word.

    a) Determine level of introduction and frequency of occurrence of contractions, abbreviated words, etc.

    b) Consider grade level guidelines for the introduction of contractions.

    c) Would the use of ungraded text material affect introduction and guidelines.

C. Space saving is no longer the important consideration that it once was and now greater emphasis should be placed on the readability of braille.

D. In making and considering changes in the code, formats, rules, etc. it should be kept in mind that research has indicated that the unit of recognition in reading braille is the individual character and that all of the characters in a word must be sensed in a spatial-temporal sequence. In these respects braille reading is dissimilar to print reading.

E. Should the user of books be considered in transcribing and should separate rules or guidelines be developed, perhaps, for teachers and students.

1. Should a grade level factor be considered in conjunction with the transcription of books.

2. Should teachers edit the books before they are transcribed.

3. When perfecting the code should attention be given to the fact that public school children often have no one available to interpret symbols, formats, rules, etc.

4. Should there be two levels or grades of braille, one for the multi-handicapped or retarded and one for the average visually handicapped, viz. grade 1 1/2 and grade 2 for the respective groups.

F. Should special symbols and symbols of other codes be listed in the front of the book on the assumption the reader may not know these symbols.

1. What should the transcribers do if they don't know the other codes.

2. Would it be possible to determine the most commonly used special symbols by grade level.

3. On the assumption the reader knows the other codes could just a transcriber's note be used specifying the other codes which appear in the book. Should different types or levels of books be treated differently.

G. It is generally accepted that transcribers prefer not to have to decide the resolution of ambiguities and the determination of format. Inasmuch as the transcribers annually produce more titles than any other organization this consideration should be central to any future work on the codes

H. Computers are playing a more important role in the production of braille and future work on the code should be focused on this development.

II. Problems involving symbology.

A. Should the same sign be used for parentheses in both the literary and math codes

B. Should all numerals be in the lower part of the cell just as they are in the math code. This practice would necessitate the use of a special indicator to distinguish the numerals from punctuation. What could this sign be.

C. Should some of the infrequently occurring elements of the code be deleted on the basis they detract from readability and do not save much space.

D. Could some provisions be made to eliminate floating dots, the condition in which the relationship among dots in two or more cells makes the level of some of the dots difficult to determine. Would the grade level of the reader affect the readability of these configurations.

E. Contractions - their use according to the rules involves many exceptions and inconsistencies. Should their use be reviewed, and should an effort be made to eliminate the exceptions and inconsistencies.

1. Should they be used wherever they occur in the word. What should be done when their use leads to confusion about the meaning of the word.

2. Should some conditions be fixed for their use in prefixes or suffixes or syllables. Here, some of the rules are ambiguous and should be clarified.

3. Should usage be the same for all types of words and content.

F. Short-form words - their use involves many of the same considerations as those for contractions above. Why should exceptions to their use be made on the basis of commonness, pronounciation, spelling, etc.

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      1.   Should some of the short form words be eliminated because of their infrequent use.

      2    Should other short form words be added to the code.

  G.  Abbreviated word forms and measurements - should their use and rules be reviewed

      1.   Should some of the forms of measurements be eliminated because of limited usage, e g  shilling, stone

      2.   Should new abbreviations be added and a standard list devised Would a special dictionary be desirable

      3.   Should grade level considerations be made regarding their use

  H.  A new sign is needed for the interobang symbol.

  I.  Symbols and rules are needed for other and newer print strategems which are constantly being developed.

III   Problems of formating

Is the proposition factual that most braille readers prefer all material flush with the left most margin because it is more accessible and diminishes search time.

  A.  Cover identification, title pages, notes, appendices, and indices.

      1.   Considerations involving the cover identification of books.

          a)   Where on the cover is the best place to identify or title a braille volume.

          b)   Where would the title be most accessible.

          c)   In which direction should the title run - horizontally or vertically.

          d)   What information should be included along with the title. Could the Arabic numerals be substituted for the Roman for the volume number on the binding.

          e)   Should there be different ways of titling books produced by press or publishing houses and those produced by transcribers. Guidelines are needed for both braille and print title pages.

      2.   Title pages.

          a)   What would be the best format for title pages.  Where should material be placed on the page.  Should it be left-justified.

b) Should different items of information be included for different types of material, e.g. the initial letters of words contained in a volume of a dictionary.

3. Notes of all kinds, including marginal information and glosses.

a) Could notes be classified as to their kind and function and should they be treated accordingly. Particular attention should be given to the notes of plays.

b) Should their length and number enter into how they are classified.

c) Are the rules governing the use of footnotes for foreign language (section 5, T.F.) adequate for all prose material.

d) Where should the notes be placed - next to word, at end of line, at end of sentence, at end of paragraph, at bottom of page, at end of chapter or section, in back of volume, in back of book, in separate volume.

e) Could their classification determine where they are placed.

f) How can they be referenced or indicated.

1) How can the reader determine which note goes with which indicator - by numbering, by repeating word.

ii) Under what conditions should the two procedures be used.

iii) Should there be different indicators for the different types of notes.

g) When referencing material should the Arabic numbers be substituted for Roman numerals as the code recommends.

h) What should be the order of presentation of footnotes and glosses when both are copious

1) What are the conditions on which the orders are based.

11) Where and how should the pages be numbered when the notes or glosses are continued over several pages

1) Where and how should the author's initials or other references be placed and indicated when they are found below and to the right of a passage or verse and sometimes preceded by a hyphen or dash.

4. Indices

a) Are they in their most readable form.

b) Should the words be fully capitalized or italicized when they appear as such in print.

c) How should they be paginated - (see pagination lii C 3).
What should be done when a volume starts in the middle of
a page.

d) What should be done with subheadings   How should they be
indented   (See Runovers, lii A, Math and Science Area)

e) Should a standard terminology be developed for the charac-
teristics of braille and the rules of format, etc. to be
used in manuals and texts dealing with braille.  Should only
what is used in the official code book be the standard.

5. Where should appendices and material, which is referred to
and needed in the text but wh ch is ordinarily  found in the
back of the print book, be placed in the braille book - within
the volume where the reference is made, at the back of the braille
volume, in the last braille volume, or in a supplement.

a) Should its location be contingent upon the significance
of the material.

b) Could such material be classified according to different
types.  Should size or amount of material determine placement.

c) What should be done if the material is referred to re-
peatedly throughout the text.

d) Could guidelines be developed to indicate how such material
should be handled.

6. Should there be more braille explanatory material in the
glossary sections of books.

B. Pagination and other designata.

1. Should the title of a book appear on every page.

a) Should it be spelled out or only initialed or abbreviated.

b) How should it appear, with or without cap signs.

c) Where on the page should the title appear.

2. Where and how should the braille and  ink page numbers be
indicated.

a) Where on the page would the numbers be most accessible.

b) Should the ink print page number appear at the top or the
bottom of the page with the braille number opposite or adjacent
thereto.  Should the numbers be on the right hand side of
each page.

c) How should the numbers be indicated when the ink page
stops somewhere within the braille page

d) How should the pages be numbered when an article, e g
biography, is inserted between the pages of a text
Could the phrase, "continued on page so and so", be used

3  Numbered and lettered lines including those which are to be
counted or otherwise reckoned

a) Where should the numbers be placed, and how should they
be indented and spaced

b) In the Bible the print numbering practice varies, should a
standard practice be developed for braille.

c) When lines are lettered should the letter sign be used

C. Systems of pronounciation, pronounciation marks, and punctuation

1. In the 1970 addendum to the Braille Format and Techniques
manual diacritical notation has been worked out for five new
dictionaries - Webster, New World 1970, American Heritage,
Random House, Funk & Wagnail, and Scott-Foresman. Should
these systems be evaluated

2. What is the purpose of having three types of stress signs
Are they all needed

a) How do these signs affect the readability of words

b) Is there a grade level factor involved in their introduction
and use

c) The conditions for using these signs needs to be clarified
and specified more rigidly

3. What should be done with diacritic markings appearing in
spelling books which are different from those provided in the
code. Mark according to and referencing new code revisions.

a) Should special signs be provided and noted

b) Should ones from the code be used.

c) Should special symbols be delineated in a standard way

d) Occasionally phonetic and diacritic signs are used together
which means that the same signs having different meanings
are being used in the same word

i) Would the use of a special indicator resolve this problem.

11) Could warning statements or notes be used to differentiate or specify the different systems that are used and how they are used.

4. Should the division and hyphenation of words at the end of a line be eliminated.

   a) How much space is saved by the use of the hyphen.

   b) Does use of the hyphen affect readability.

   c) The hyphen is not used in the literary braille computer translation program.

   d) Should a word be divided and hyphenated at the end of a page.

D. Plays, poetry and foreign languages.

1. Plays

   a) A standard method of representing should be devised. Should the standard method be related to the type of play.

   b) What would be the best way of differentiating actors parts, stage directions, and stage settings.

      1) How should the different actors parts be represented. How should it be indicated that a second speaker is to complete a line.

      11) How should stage directions and settings be represented. Where and how should they be placed. How should they be designated

      111) Where should notes be placed relative to their reference. How should this situation be treated where the notes are copious. (See IiIA 2)

2. Poetry

   a) What is the best way of presenting poetry. Should a standard method be devised.

      1) What should be done with poems having unusual formats, e.g. shaped like a tree, or the work of E. E. Cummings.

      11) If the print format is not followed how could the appearance or structure of the poem be indicated to the reader. Is it necessary to show this.

iii) Should a transcribers note be used describing the structure of the poem

3. Foreign languages

a) All languages for which braille notation is available need study of their symbology and its use. Review should be made of M. Loomis Standard English Braille in 20 Lessons, 1947, for her treatment of accent and diaeresis signs in foreign languages

b) Transcribers should be consulted about foreign languages because there are differences among them in the way they treat ambiguous or problem situations.

c) In print language texts much of the material is presented spatially - how should it be done in braille. Some guidelines for certain braille representations can be found in the grammar section of the Textbook Code and need to be cross-referenced

d) Should notation and rules be developed for languages for which provisions are not presently available, e.g. Portugese.

e) In developing material for foreign languages it should be kept in mind that the transcriber doesn't necessarily know the language with which he is working

f) It is the attitude of many that English braille and foreign language braille should be kept separate, i.e., special provisions for each.

   i) In changing or shifting from English to a foreign language, e.g. in a grammar book, there is nothing to indicate the change, which situation is confusing to the reader

   ii) Should some symbol be used for this purpose. Could the italics sign be used to show the change of language. If so, what would be done with material that is already in italics.

   iii) More provisions on the use of italics in these situations are needed in the IF manual.

g) For the transcription of foreign words braille, grade I is used while the other characters represent accent and sounds.

   i) The braille phonetic code conflicts with braille accented letter signs of foreign languages - could this situation be remedied.

i) How should inflections within and between words be
represented in foreign language transcription  For
rules on inflection between words the foreign language
section of the TF manual needs to be cross referenced
with the speech instruction section

iii) Should the slash, which ordinarily has no space on either
side, be accompanied by spaces if it appears so in print.
In  Spanish and italian the sign for the slash also
represents the vowel sound i acute   Could the dash
be used instead of the slash symbol

iv) In foreign languages italicized vowels mean that the
vowel is stressed, however the s also is frequently
italicized which indicates it carries the "z" sound
How should these items be represented in braile where
there is a special sign for stress and a sign for italics.

v) In Italian acute symbols for the vowels are needed

vi) When the text or main part is in one language and a
footnote or reference is in another should the accent
signs differ for the same word in the different languages.

h)  The diaresis i in French Textbook Format allegedly is
confused frequently with the macron   What could be done
to eliminate this confusion

i) When most of the words of a sentence are in English what
should be done when to, into, or by comes before a foreign
word   Should these prepositions be contracted or written
out and should they be placed adjacent to the foreign word.

j) In German only the first letter of nouns is capitalized
and the double cap sign is not used - capitalization serves
as an earmark   When following the rules for titles and
using double caps, what should be done to distinguish words
capitalized within the title

k) In the TF manual could the words "in the entry" be inserted
after "used" in the first line and the colon and defini-
tion be added to the examples to clarify that item.

l) On the title page of foreign language books the title uses
the special symbols of the language but the rest of the
information - author, publisher, etc   is in English
Is this a desirable practice - how should the title page
items appear.

m)  In Spanish the opening and closing conversation signs are
    confusing. In print it is a dash. The braille sign
    misleads the student and violates the braille rules when
    used adjacent to a period   What should this sign be?
    Could it be a dash the same as in print. A rule is
    needed specifying that the Spanish custom of not using
    a closing conversation sign should be observed by
    transcribers.

n)  In foreign language should the division of words and
    hyphenation be treated differently from the practice
    of English braille   To what extent should the foreign
    language format be followed compared with that of
    English braille.

E.  Print devices for emphasis

1.  Headings, capitalization, lines above and below, color,
    etc. are means of emphasizing or distinguishing material in
    texts   What should be done with them in braille.

    a)  Should the transcriber have to determine whether these
        devices are only commercial artifices or meaningful to
        the text

    b)  In resolving these problems a central consideration should
        be the differences between working on plastic, paper, and
        metal.

    c)  Transcribers usually delete as much of these devices as
        possible - Should there be conventions for this.

2.  What should be done with italics and the italic sign.  The
    Braille Authority has been asked to eliminate this sign.

    a)  Its use requires a subjective judgment of what should
        be emphasized or distinguished.

    b)  There is also the matter of when it should be introduced
        in Braille.

    c)  What effect does its use have on the readability of braille.

    d)  Could more meaningful objective conditions for its use
        be established

3.  Double caps - In ink print there are three types of caps -
    should these be represented in braille.

    a)  When should they be used or not used   Should some
        other procedure be used for directing attention to the
        material.

b)  When a considerable amount of fully capitalized material
    appears within the text should some symbol other than
    the double caps before each word be used.  Could the
    italics principle be used

c)  How much space should be saved for varying amounts of
    material using double caps as opposed to a symbol
    preceding the capitalized material.

4   Underscoring   What is the best method - dots or smooth line.

a)  Should spacing between underline and material be considered.
    What is the optimum spacing between the line and the
    material above and below.

b)  Is there a grade level factor involved which is related
    to spacing

c)  Should italics be used instead of underline.  Under what
    conditions should the italics sign be used. When should
    the switch be made

5.  Paragraph headings - material on headings needs review and
    clarification

a)  Have too many distinctions and provisions been made for
    the different forms of headings, subheadings, etc.
    Could this matter be simplified.

b)  Should a line be skipped before a heading to emphasize
    change in topic

c)  Could the differentiae for the various types of headings
    be specified   Should the treatment of these types be
    standardized or only kept consistent within a text.

6.  Colored type - its use is on the increase considerably.

a)  What should be done with colored print - should it be
    coded, or boxed or underlined, etc.

b)  Should a judgment be made about whether the material is
    meaningful or referenced in the text or whether it is
    merely for eye appeal, and then treated accordingly.

c)  What should be done with colored sections of books.

d)  What should be done when different shadings of colors
    are used for different purposes.

e)  Should different constructions be developed for different
    situations - could these situations be listed.

7.  Where and how should arrows be placed that point to words or
    different parts of words.

    a)  Should different practices be set up for different
        situations.

    b)  Can these different situations be determined.

IV.  Problems of Displays - Displays are considered here as any figures,
     drawings, etc. which are part of a textbook, but which have an integrity
     of their own, and can be treated separately from the text and its format.
     A note of caution, the meaningfulness of this definition is limited
     because ultimately what is importnat to the reader reduces to that of the
     readability of the whole braille page.  For more considerations on this
     topic see Maps, Charts, and Diagrams Area.

     A.  Outlines, tabular, and test materials.

         1.  Outlines - related to numbered sections, numbered sentences,
             exercises, drills, tests, headings, table of contents, and
             poetry.

             a)  Is the present form of successively indenting each subunit
                 two spaces and bringing runovers to the margin the most
                 readable.

                 i)  What should be done with large outlines.

                 ii)  Should a line be skipped between groups and before
                      a topical heading.

             b)  New publishing techniques are replacing the traditional
                 standard outline format.

         2.  Tabular material

             a)  What is the best arrangement or technique for presenting
                 this type of information.

                 i)  Should it be presented horizontally or vertically.
                     What is the best arrangement in each case.

                 ii)  Should different types of material be presented in
                      different ways.

                 iii)  Could tabular material be classified.

             b)  What should be done with large tables running across a
                 number of pages.

                 i)  How should the tables be segmented.

                 ii)  Could techniques for using facing pages be developed.

c) How should columnar headings be indicated.

    1) Could they be keyed.

    ii) Does their treatment depend on their length.

d) What should be done with footnotes in the table.

e) What concepts should be taught to children to enable them to read tables.

3. Test materials - consider with outline and tabular materials. For this item the only concern is with readability.

    a) Should different types of test material be treated differently.

        1) Requires classifying different types of tests.

        ii) Should tests also be classified according to types of response required.

            A) What would be best way of marking answers - depends on responses required.

            B) What should be done when answers are to be checked, circled or underlined - need keying technique, what is the best type of key.

    b) How should columned material be numbered or designated. Review Rule 12 and Appendix E in the Textbook Format manual.

        i) Is horizontal or vertical numbering the most readable.

        ii) For public school blind children are the designations similar to those used by the sighted child and teacher.

    c) How should materials be divided within a page and across pages.

        i) Should questions and answers be separated across pages.

        ii) For long columns of materials could facing pages be used.

B Pictures and picture captions

1. In general, pictures cannot be reproduced in an embossed form and be tactually meaningful. Also, transcribers express the feeling they are not qualified to determine the educational value of pictures or describe the pictures adequately or in the appropriate vocabulary

2. Should efforts be made to develop simple embossed pictures or symbols to represent frequently occurring objects or shapes.

3. What should be done if the pictures cannot be represented. What if the text is dependent on the pictures or that the pictures have some function, e.g. counting.

   a) Should the pictures be described. What is their educational value - can this be determined.

   b) What if questions are to be answered from the pictures.

   c) Should the vocabulary level of the description be considered.

   d) If special symbols are used in place of pictures where and how should they be placed on the page.

   e) Does their placement depend upon their function. How can this be determined. Could common functions be classified and guidelines developed for their use.

4. Should the representation of pictures be considered from the standpoint of lower and upper grade levels.

5. Should social-emotional effects of having materials similar to sighted peers be investigated.

6. What should be done with the captions of pictures.

   a) Where should they be placed.

   b) If the picture cannot be represented, what should be done with the caption.

      i) Should it be included. Should its inclusion depend on the information it contains.

      ii) Where should it be placed on the page.

      iii) What would be the optimum size of books when pictures are deleted and there are only one or two words per page.

      iv) How and where should these kinds of pages be numbered.

C. Business forms

1. Very little work has been done in this area. The area needs considerable research and the development of techniques and guidelines for handling the many diverse forms.

    a)   Efforts made in this area should consider the changing nature of the forms, especially those changes coincident with the use of computers in processing forms.

    b)   Could the different types of forms be classified and techniques and rules developed for the most common types.

2.  The principal problem with forms is that most are too big to fit on a single braille page.

    a)   How should the detailed and small print information be handled.

    b)   Could keys or symbols be used to indicate the location of information with the information appearing elsewhere.

    c)   Could a procedure be used wherein the overall form is presented first with the sections numbered and later elaborated. Should the overall form be presented before or after the elaborated sections.

    d)   Could facing pages be used in presenting the forms.

3.  In addition to business forms work needs to be done on time tables, schedules, etc.

4.  Should a manual of guidelines and instruction be developed for this area, or would it be better to enlarge this section in the code book.

D.  Diagrams

1.  What is the best arrangement for diagrams and where should they be placed on the page

    a)   How should larger diagrams be handled - could or should facing pages be used.

    b)   Could keying techniques be used in diagrams thus allowing a smaller representation.

2.  Should different types of lines be developed for different figures and diagrams or parts of diagrams.

3.  In the format book examples are needed for simpler types of sentence diagramming.

E.  Time Lines - rules are needed for these figures. They are presently treated in an outline format.

1. Should they be handled differently depending on whether they appear horizontally or vertically, or should a standard method be devised.

2. What can be devised to indicate the points to which the lines refer.

3. How should instances of overlap be treated.

F. Family trees - these displays need directions. They are presently treated as outlines.

   1. Can some other method be devised for their representation - can they be displayed diagonally perhaps across facing pages.

   2. How should married relations be treated.

VI. Factors needing development

A. Biology, Botany, Zoology.

   1. Needed are notation, formats, and rules.

B. Medicine.

   1. Needs complete development.

C. Geography and geology.

   1. The big problem in these areas concerns maps, charts, etc.

D. Linguistics.

   1. A new area gaining rapidly in acceptance and for which symbology and rules are needed.

E. Money and Commerce

   1. Items of difficulty in this area have to do with diagrams, tabular material, stock reports, etc.

F. Biblical reference symbols

   1. Most of the problems have to do with the vagaries of numbering found in the different editions of the Bible and how they should be treated in braille.

   2. Should a standard numbering system be developed for all biblical references.

   3. Should the biblical reference symbols currently used be evaluated.

G. Coding

    1. Refers mainly to Morse code, semaphore, and cryptography and
how these systems can be represented tactually.

    2. Also includes cross word puzzles, acrostics, chess moves,
bridge displays, etc. which would be related to tabular and
graphic display materials.

H. Cooking - the representation of recipes and instructions.

    1. What kind of format should be developed for recipes. Should
it be standardized.

    2. Should a standard list and symbology be developed for the
measures and tools used.

I. Handicrafts - sewing, knitting, crocheting, tatting, weaving,
basketry, etc. all need symbology, rules, and formats for direc-
tions and displays developed for them.

Braille Codes Pilot Project

Outcome of Endeavors of Music Committee

I.  General Considerations

A.  Computerization of music

1.  Computers will eventually play a significant role in the
    production of braille music, especially for the simpler
    and elementary level music.

2.  The braille representation of the more complex music
    requires stylistic and interpretive decisions which will
    be difficult for the computer to handle.

3.  The American Printing House for the Blind has embarked on a
    project to develop a computer assisted music translation
    program.  The initial phase of the project runs from
    May 1971 to June 1972.

4.  The computerization of braille music will lead to a more
    standardized reporduction than was heretofore possible.

    a)  Decisions concerning problems in the present code
        should be made in light of eventual computerization and
        standardization of practice.

    b)  On the other hand, any changes in the code should be
        made from the standpoint of the reader and a workable
        code and not ease of computerization.

B.  Print music

1.  In print music there are different ways of depicting the
    score; also there are anomalies peculiar to a composer or
    autographer, and sometimes the text contains errors.  What
    should be done with these things - should the anomalies and
    errors be changed; should standard guidelines be developed
    and specified for these variables.

2.  The exact duplication of inkprint copy results in the
    representation of some unnecessary symbology and material
    in braille, e.g. clef signs and parentheses.  Should there
    be less emphasis on showing exactly what is in print.
    Could conventions be established for what should be included
    in braille.  Should a grade level or a beginning music level
    factor enter into what is represented in braille.

C.  There are a number of different methods of presenting braille
    music, e.g. bar over bar, line over line, etc. whose use is
    determined by considerations based on the music.

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1.  Can the conditions under which these methods are used be
    specified and listed.

2.  Should one method be preferred to another.  Could the best
    method be determined.

    a)  Should bar over bar be used in preference to line over
        line for simple and elementary music.

    b)  Should line over line be used more often.  Under what
        conditions.

D.  The reading of intervals for solo instruments in the trebel
    clef and orchestral scores varies - solo read downwards and
    orchestral read upwards

    1.  Which is the best method of reading.

    2.  With the exception of keyboard music why couldn't all intervals
        be read upward.

E.  The code book needs more directions and greater specificity
    of rules and guidelines.  Also needed are more complex types of
    examples where the notation runs for two or three parallels
    for each hand.  This material could be placed in a supplement
    or addenda and cross referenced with the code book.

II.  Problems involving symbology

A.  <u>In accord</u>:

    1.  Under what conditions should full measure in accord and part
        measure in accord be used.

        a)  Could rules be developed to determine when the two
            "in accords" should be used, e.g. defining short and
            long measure, the former being the case where both parts
            will fit within one braille line.

        b)  Can the conditions be specified for the arrangement of
            parts, relative to the in accord sign, which tend to
            preserve the melodic character or continuity of the
            measure.

B.  Repeats

    1.  In general limitations regarding when to use repeats need to
        be more precisely delineated in the code manual.

    2.  When measures are repeated from one page to another should
        a repeat sign be used at the beginning of the new page or
        should the measures be written out.

3. Could conditions be determined for specifying when repeats should be used with certain types of material, e.g. vocal, and with variations in the music, e.g. with strong and weak beats.

4. In partial abbreviations is the repeat with the number sign confusing - this usage requires the counting of measures.

5. In the use of octave repeats does the space between the characters cause a loss of orientation and determination of level of character.

C. Grouping

1. Could the conditions for the irregular grouping of 16ths be clarified and expanded. Is it desirable to use the music comma and grouping symbol together.

2. Where notes are grouped and a visiting hand must play all or part of the group, should the hand sign be placed before or after the grouping sign. This situation needs specification in the code manual.

D. Accidentals

1. In carry-overs to a new parallel should the accidental sign be repeated. Conditions covering ties and accidentals need clarification in the code manual.

2. When a tie occurs at the beginning of a new measure should the accidental sign be repeated before the second of two tied notes.

E. Accents.

What would be the best order or arrangement of the accent signs. Should they be alphabetical with staccato signs coming first or would some other type of order be more desirable.

F. Clef signs

1. For changes within a parallel how significant are they. In this situation could the clef sign be eliminated for the braille reader. If the sign were eliminated should provisions be made for the teacher.

2. Should a transcriber's note, possibly in the front of the music, indicate their absence.

3. For a tenor part written in trebel should the notes be transposed an octave lower by the transcriber.

G.  Braille Rests

    1.  Their indiscriminate use is often confusing and breaks melodic
       flow.  Can conditions governing their insertion be amplified.

    2.  Should symbols showing loudness or softness precede the rest
       sign or come before the note   Could more adequate provisions
       be made for this condition in the code manual.

H.  Ties and Slurs

    1.  When beats or measures are tied together in a new parallel
       or line should the tie sign be used again before the new
       measure and before the in accord sign.  The rule implied in
       example 97 of the code manual needs changing or clarification.
       Also, two examples of this situation in the manual are
       contradictory.

    2.  Where should the tie or slur sign be placed when the repeat
       sign precedes a numeral.  A rule covering this situation is
       needed in the code manual.

    3   To avoid confusion and promote easy recognition of the
       course of the music how should a slur used in one voice but
       not another be indicated.

    4   Under what conditions should the grace note slur be used.
       Should it only be used under the bracket slur.  Clarification
       regarding the use of this slur is needed in the manual.

I.  How should stem signs be applied to show that the word
    distribution is different in two languages.

J.  The present practice of marking octaves apparently causes
    difficulty for the beginning student.  Could all intervals beyond
    the second and third be marked.  Should marking all intervals
    be confined to introductory materials.

K.  Symbology needed within framework of present code.

    1.  A sign is needed indicating the use of two fingers striking
       a note.  Could it be a dot before the second finger mark.

    2.  A symbol is needed showing a tie from part of one measure to
       part of another measure, a part-to-part tie.

    3.  A sign is needed for a slur which is not tied to any note
       at all, a null-tie.

    4.  In some configurations it is difficult, especially for the
       young child, to determine alignment or level of dots.  Could
       a reference sign be developed to aid judgment.

5. Symbols are needed for new print signs of operations and functions which are continually being developed, e.g. wah-wah. Such signs can be found in current music dictionaries.

III. Problems of Formating

A. Nuances and word expressions.

1. Where unequal expressions or directions appear at the beginning of a new measure how should the first notes of each hand be aligned.

a) Disregarding vertical alignment on the pedal sign should alignment be different for symbols of execution and pedaling.

b) The rules governing the practices of alignment in the code manual are not specific enough and the examples shown are inconsistent.

2. The directions regarding the placement of the ends of diminuendos and crescendos need to be clarified and expanded.

B. Choral and vocal music

1. Should there be one way of juxtaposing the words and music.

a) Since there are usually more words than notes and to prevent one hand from going under the other should the words always be above the music.

b) Should the poetic line and the music correspond or be vertically aligned.

c) Should exceptions be made for different types of material.

2. Could a sign or some other indicator be developed to show when a syllable is stretched over a number of notes.

3. Where and how should a word or syllable be divided between lines.

a) How should the hyphen be used to divide the word or syllable.

b) The rules covering this situation need to be clarified and extended.

4. At the elementary level when the words go with the music is it better not to have runovers of the music.

5. Could the lines of words and music each be placed on separate facing pages

C. Measure division and runovers.

    1. For in accord measures where one hand is longer than the other and longer than a braille line should you use runover lines or bring the remaining part to the next parallel.

        a) What should be done when both hands are longer than the line.

        b) Where should the division be made.

        c) A rule is needed to cover this situation. - present rule inadequate.

    2. For complex music rules governing runovers are inadequate. Rules are needed covering the exceptions in very florid types of expressions where proper division cannot be made.

    3. In general more rules and examples are needed covering runovers in a greater range of situations.

D. Pagination

    1. What is the best manner of numbering pages.

    2. Should page numbering be the same in music, theory and textbooks, and manuals

E. Measure numbering

    1. In what cells should the numbers begin.

        a) How should spacing be done for digits, tens, and numbers. Spacing should allow for dot 3 indicating runovers.

        b) A rule is needed covering this situation.

    2. For solo stringed instruments how often and in what form should measure numbering appear. This should be indicated in this manaul.

    3. What should be done about measure numbering in unbarred music   Could the parallels be numbered and accompanied by a transcriber's note.

    4. In choral music provisions are needed for the numbering of new braces or the beginning of new braces.

F. Key and time signatures

    1. Should the key and time signatures of the score be placed at the top of every page.

2. Should the change of signatures within a page be included.

3. Could something be devised to indicate which keys are to be played. This is particularly important for the young child.

G. Footnotes

1 How should footnotes be indicated. Clarification is needed in the code manual.

2. Where should they appear relative to their indication.

a) Should the note be placed within the piece following the parallel in which the indicator occurs, at a suitable break in the music, or at the bottom of the page.

b) Should the note be indented or placed under the hand signs.

c) Should the notes be separated from the other material by lines of dots 3 and 6.

H. How should figurations be handled which are to be performed with both hands but written in one voice.

I. When a light double bar is presented along with a fermata in what order should the braille signs appear. A rule is needed for this situation in the code manual.

J. At the beginning level the code advises an extra space between lines. How does this affect the child's ability to align the notation vertically. If the practice is not followed the rule should be deleted from the code manual.

K. Is the use of tracker dots adequate. Should they be used in situations where there is less than seven spaces between symbols. Should a grade level factor be considered with regard to their use.

L. Formats for theory books

1. Formats require considerable study and guidelines for transcribing.

2 Figured bass and chord analysis.

a) Rules and symbols are needed for this material.

b) What is the best way of presenting.

c) Is interval interpretation easier when represented by numbers.

        d)   For reading intervals the current code symbols are in contradiction with print and with logical ordering in harmonic constructions. Could more desirable alternatives be developed.

   3.   For exercises showing intervals how should chords be represented - should they be spelled out using the in accord sign.

IV.  Factors needing development

  A.  The development of notation and rules for different types of music and materials.

    1.  Tonic Sol-fa.

        a)   The notation for this method is presently going out of use. The majority of educators now favor the fixed dō, however its use still preponderates in the public school system.

        b)   Rodenberg has developed braille notation for this type of music and Jenkins has adapted it to correspond with the music code. Jenkins'adaptation could be part of an addendum to the code manual.

    2.  Liturgical music - Gregorian and Anglican chants.

        a)   For Anglican chant a code developed by Rodenberg has been revised by Jenkins. This revision could be used in any future developments.

        b)   Should both methods of presenting - numismatic and round - be considered for development.

        c)   How should material be written if accompanied by organ.

    3.  For ensemble piano music alternative ways of presenting the material needs to be examined.

    4.  Orchestration

        a)   In full score the horizontal placement of notes is important - could the word sign before the instrument be eliminated to gain an extra cell which is sometimes needed.

        b)   Examples of orchestral scores are needed for the code manual. These could be included in an addendum to the code

        c)   Full conductor's scores - should more of the type material be transcribed, how much of a demand is there for it. Need survey

5.  Band material - not adequate supply - the residential schools would like considerably more of this type of material.

B.  The development of notation and rules for different instruments.

1.  Accordian - Should the 7th octave sign be used for those accordians which have the augmented interval.

2.  Drum score

    a)  Need notation for notes and procedure. Would open score be better than in accord - may be more suitable for computer production.

    b)  Should a choice be made between the two methods of presenting - should you use the left, right hand signs or the left, right toe signs as borrowed from the organ

    c)  Could other percussion instruments be given a note on the staff in positions not occupied by the snare and bass drums. Guidelines are needed for selecting these instruments

3.  Guitar

    a)  Is now very popular  Needs considerable study and development of notation

    b)  Should octave transposition be made for guitar by the transcriber.

    c)  Notation is needed for showing picking patterns and all types of fingering - right and left hands, rest stroke, free stroke, flamenco roll, etc.

    d)  Because of greater frequency of low notes should note reading be done upwards.

    e)  Should grand barre' signs alone or with the continuation sign be used for capo, a transposing device.

    f)  In general could the up-pedal sign be used for damping of all instruments.

    g)  Could something be devised for representing tabulatures.

4.  Harp

    a)  Needs considerable notation and rules for functions and procedures of music and teaching materials.

    b)  Edward Jenkins is presently working on the codification of braille for this instrument.

5. Mandolin · Treat with guitar   This instrument is fingered like a violin and strummed with a double stroke. A major problem involves the use of signs for position vs. fret.

6. Organ

   a) Should use of open score be contingent upon whether music ishomophonic or polyphonic.

   b) Parentheses differentiating the Hammond and other organs are used indiscriminately. Should different signs be used for the two classes of organs - perhaps the parentheses for the Hammond and the word sign for the others.

   c) When registrations are given for both classes of organs at a certain point in the music how can they be differentiated.

   d) Provisions for chord organs need to be established.

7. Solo wind instruments

   a) How should finger charts be displayed.

   b) Could charts be compiled into separate pamphlets for the various instruments

8. Recorder

   a) Much music has been done in England for this instrument.

   b) Fingering presents a problem - need charts to indicate what fingers produce certain notes.

9. Modern Electronic music - elements and notation too recent and unstabilized. Should not consider at this time.

10. The code manual.

    a) The code book needs to be reviewed for completeness, inconsistencies and errors.

    b) The general index of the manual is inadequate and needs elaboration and cross referencing.

    c) The designation braille music comma should be changed to the ligature sign

V. Resources for future development

A. The items listed in this section are far from a complete specification of the considerable amount of work and talent which exists

in the field of braille music. They are merely a few resources
which were mentioned during the committee meetings and which
would be available for further work on the code. Foremost among
them are the members of the committee and especially Mr. Edward
Jenkins who is currently devoting considerable time to
abrogating some of the insufficiencies in the area.

B.  Messrs. John Siems and William Watson at APH are currently
    developing a computer assisted braille music translation
    program.

C.  Mrs. Erlandsen is presently engaged in reducing and revising
    orchestral scoring in braille.

D.  Mrs. Stella Jenkins has developed a system for brailling the
    Tonic Sol-Fa notation.

E.  A comprehensive source for information about orchestral music
    is the Thesauras of Orchestral Effects by Gardner Read.

Braille Codes Pilot Project

Outcome of Endeavors of Math and Science Committee

I.  General Considerations.

A.  In planning or considering codes for different fields some
    variables are distinctive to each field and others are common
    across all fields - vertical and horizontal factors. An attempt
    should be made to make codes compatible horizontally or where they
    share commonalities and avoid having different symbols for the
    same or similar situations.  This requires the determination of
    common elements. Would a computer be useful in listing or keeping
    track of instances where symbols or rules are used.

B.  Possibly useful would be a distinction between format problems and
    problems of spatial arrangement.  The latter refers to relationships
    internal to an item such as a diagram or graph, and the former
    refers to relationships of the text to the page and to other items
    on the page.  On the other hand, this distinction cannot be applied
    too rigorously because the readability of the material must be
    determined within the context of the page, and thus it is the total
    arrangement of the material on the page which is important.

C.  Concerning a philosophy towards the translation of print material
    into braille the following points should be considered.

    1.  Insofar as possible should there be an exact duplication of
        print to braille or should the print be edited on the basis
        of what is tactually meaningful.  In other words, should greater
        emphasis be placed on imparting the concept or comprehension
        of the material rather than making the braille isomorphic with
        print.

        a)  How important is it for the student to know what the print
            format is like.

        b)  What factors relevant to the issue should be considered
            from the standpoint of visually handicapped students in
            public schools

        c)  Editing entails a decision of what should be reproduced.
            Who should make this decision and on what basis.  What
            kind of editing is useful or desirable.

            i)   How would editing affect transcribers.  They do not
                 want or feel qualified to decide what should be
                 deleted or changed.

            ii)  Should teachers edit the books before they are transcribed.
                 Relatedly, could procedures be worked out for transcribing
                 both parts or sections and the whole of a book.

          iii) Would joint teacher-transcriber editing be feasible
and resolve some of the problems inherent in the
issue.

          iv) Should grade level considerations enter into this
matter. Should an attempt be made to determine what
the regular class teacher of the lower grades, K-4,
requires and expects of the blind child with regard to
the use of the material in print books. How much is
meaningful and used by the resource or itinerant
teacher Could information of this type provide the
basis for editing lower level math books.

2. At the elementary level teachers feel that the math code is too
complex and that more time is spent working with the code than
with the math concepts.

   a) Some code elements may interfere with the concepts being
taught, e.g. work with square figures often does not occur
until the third grade but the symbol for the square is
introduced in the first grade. How does this situation
influence the child's concept of a square.

   b) Could the code be simplified for elementary level students.
Would a graded teaching manual alleviate some of the
difficulties with the code encountered by the young child.
Should math series be surveyed for introduction of symbols
and concepts and the results used as a basis for the intro-
duction of symbology. Would changes in subject structure or
curriculum affect the manuals.

D. Should lesson books for the codes be developed for teachers.

E. Should manuals of format and techniques be developed for each of
the codes Should the manuals be cross referenced and specify
priorities of rules and codes which take precedence.

F. A recent revision of the math code has been made but it has left
unattended a number of items which should be included in the code.
A review of the code is needed to determine what is missing and
what should be included.

G. According to volunteer agencies, Nemeth Code transcribers are
diminishing.

1. Eventual certification of math transcribers presumably by
the Library of Congress is anticipated.

2. Absence of official adoption of the Code has been considered
partly responsible for the decrease.

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H. Because of the few number of volunteer transcribers of the math
code and the increased use of computers in the production of
literary braille efforts should be made to computerize the math
and other special codes and to consider this contingency as
central to the development of other codes.

I. There is general agreement that the American Printing House for
the Blind should assume a leadership role in the work on the
development and standardization of the braille codes and on
assuring the future production of braille.

II. Problems involving symbology.

A. In the math and literary codes the parentheses signs are different.

1. Should they be the same. Under what condition should each be
used.

2. In the most current revision of the math code only one sign
for the parenthesis is used. Does this revision cause other
difficulties and require other changes in the code. What
are they.

B. In the math code there are two commas. Would it be possible and
desirable to eliminate one of them  Could the characters for the
dot two comma and the apostrophe be exchanged.

C. The use of the punctuation indicator is variable. Could this
variability be eliminated and uniform conditions established for
its use.

D. Under what conditions should the English letter indicator be used.
Should the letter indicator be used at all - can the material be
read either way. In the current revision of the math code its
omission in certain situations may cause difficulty. What are
these situations and can they be corrected.

E. Are the rules regulating the use of the numeric indicator the
most efficient. Could the use of this symbol be made more efficient
and explicit.

F. Roman numerals are presently depicted using the sign for double
caps. Does this array interfere with the alignment of terms when
doing computations. For computation purposes do the terms need to
be aligned.

G. In print, fractions and cancellation both are represented two
different ways. In braille fractions are represented both ways but
cancellation in only one way.

1. Are both ways necessary and mathematically significant.

2. Are there conditions which can be determined that will specify
when each form should be used.

H. Do the directional symbols of the Nemeth Code always mean the same thing. When arrows or directional operations are represented differently from those depicted in the code can the code symbols be used.

   1. Is the meaning of the different representations the same.

   2. In print the designation of a diagrammed ray makes no distinction as to direction of the ray. Should the direction be shown in braille.

I. Math symbology needing development

   1. Symbology for ancient numeration systems - Egyptian, Babylonian, Chinese, Mayan, Greek.

      a) There is not complete agreement on how the ink symbols are depicted. Should this material be edited. How frequently and under what circumstances does it occur.

      b) Should braille characters be used to represent these systems. Could some other symbols, possibly more similar to the original, be used.

   2. Notation is needed for number systems to different bases. Recently notation was developed for bases 12 and 16. Does this notation need to be evaluated.

   3. Other special symbols which appear from time to time. Notation is needed for new symbols and symbology appearing at lower grade levels as a result of changes in curriculum.

III. Problems of format

A. Runovers (Analogous to Division and Hyphenation of words in Textbook Area).

   1. Should certain types of material be treated differently regarding division and continuation from one line to the next, e.g. linked and non-linked modes.

   2. Where should different types of material be broken.

      a) Should links in math expressions enter into and perhaps, determine where the expression should be broken.

      b) How should runovers within links be treated. Should complete links be written on separate lines.

   3. What should be done for different types of material which are divided between pages.

   4. How should the break be indicated. Does it need to be indicated. Could a priority break list be developed.

a) When divided at a sign of operation should the sign of operation or comparison appear at the end of the line, at the beginning of the next line, or at both places.

b) Should a hyphen or other type of continuation sign be used with the divided material.

c) Where should this sign be placed in relation to the break.

d) Should it appear both after the break and before the resumption of the material.

e) Should division and indicators thereof be handled differently for children in the lower grades.

B. Margins

1. Should different types of material be treated differently. Could different types of material be classified and specifications developed for the different classes

2. Where on the following line should a runover begin. Should it be indented.

3. Should different types of runovers be treated differently. What should be done with successive runovers.

4. For numbered and lettered material where should the designators be placed. Alignment should be considered for the number of cells required by the designators. (See Textbook Area, Pagination and Other Designata).

C. Variant type forms or print devices for emphasis. (See Textbook Area, Print devices for emphasis).

1. Should textbooks be surveyed to determine whether the variant forms have mathematical significance or are just for eye appeal. Could the variant forms then be classified.

2. No provisions are made for distinguishing colors, different sized type, or different types of script.

a) Should symbols be developed for these things. Should symbols be standard across areas.

b) Where should these symbols be placed in reference to the material being modified

c) Should a standardized list of symbols for colors be developed.

d) When a special braille symbol is used for a special print symbol, should the print symbol be depicted somewhere so the braille reader will know how it appears.

D. Transcriber's notes.

1. When transcribers notes and keys are used with displays what should be done about the following: placement, division, indentation, spacing, designation, vocabulary level and differentiation of author's and transcriber's notes.

2. Should there be special symbols indicating a transcribers note.

3. Where should the indicators and notes be placed relative to the material referenced.

4. For the mathematics code a transcriber's grouping symbol, dots 6 & 3, has been developed which is placed before and after the note. Is this the best form of indicator that can be devised

5. In composing notes the grade or developmental level of the vocabulary should be appropriate. Could standardized messages for frequently occurring conditions be developed.

6. How should transcribers notes be spaced relative to margins and material above and below. Should different types of material be spaced differently, e.g. literary vs. exercise material.

E. Formal proofs and definitions

1. What should be done with the development of mathematical principles; in other words, how should the theorem, hypothesis, conclusion and proof be represented.

2. How should the statement and reason of the proof be represented.

   a) Should the statement be in bold face or italicized type. Should some other special indicator be used to delineate and distinguish the two.

   b) Should the statement and reason be alternately presented. How should they be designated, divided when runover, and indented

   c) Should the statement and reason be set up side by side. Should different types of material be set up differently.

3. What should be done when a bold face or other type is embedded in another special type such as italic. Provisions are needed for this situation.

4. How should line segment designations be treated. Should a row of dots 3 and 6 placed above the material be used to designate the segment.

5.  How should other material related to proofs and definitions-
    figures, diagrams, etc. - be set up and arranged on the page.
    (See Section IV below and separate area of Maps, Charts, etc.)

IV.  Problems of Displays.  Those most frequently associated with mathematics.

A.  General considerations.

1.  In the introduction a distinction was made between problems of
    format and problems of spatial arrangement.  In this section
    problems of spatial arrangement are treated under the slightly
    broader heading of displays.  The heading, displays, is used in
    order to be more inclusive; otherwise, the two terms are
    synonymous.  In addition, the objection made to the earlier
    distinction is also applicable to the present classification,
    viz. it is the total arrangement of material on a page which
    is important to readability  The differentiae justifying
    both the present and earlier distinction are that the display
    items are ordinarily spread out and have a certain integrity
    or completeness of their own apart from the text.

    For information on more general types of displays see
    Textbook Area, Section IV and Maps, Charts, and Diagrams Area.

2.  This whole area needs considerable study which should result
    in the development of principles governing the representation
    of displays.  A useful starting point may be a survey of
    transcribers to determine what principles they use, principles
    which may be intuitive or have been passed along as folklore.
    These guides used by transcribers should be defined and investi-
    gated.

3.  In the reading or interpretation of displays there is a learning
    factor involved which should be considered when they are studied.
    There may also be a developmental or grade level factor involved
    which should be investigated.

4.  Should the different types of production - one-sided vs. two-
    sided be considered in studying displays and developing symbology
    and tools  Should the developments be the same for all types
    of production.

5.  For large displays could facing pages be used.

    a)  Could new, more efficient techniques be developed for
        setting-up and using facing pages.

    b)  Could conditions be determined under which facing pages
        should or could be used fruitfully.

6.  Could different representation techniques such as the "skeleton"
    procedure and the "building" technique be further developed
    for handling displays.

7. Could a keying technique be developed and instances where it would be useful delineated.

9. Could tools be developed for the construction of displays and symbols within the displays. Should the symbology and tools be standardized

9. Should an instructional manual on displays be developed for transcribers. Should the procedures be standardized or only serve as guides.

B. Problems of math expressions in general.

1. There are different kinds of displays for the different areas of math - plane and solid geometry, trigonometry, calculus, etc Could these displays be reliably classified and treated on the basis of their classification.

2. Could math material be classified to determine what should be spatially or linearly represented.

3. In math expressions which are spatially arranged. What should be done with such items as lines above and below material, lead lines, arrows pointing to results, arrows showing the direction of operations, boxes, steps, vertical bars, circled numbers, and numbers above and below and to either side of others

   a) How much of this material is meaningful to the braille reader

   b) What is the best way of tactually depicting this material.

   c) Where on the page should this material be located.

   d) Should a line be skipped above and below a spatial arrangement.

   e) How should the material be spaced relative to process words in equations, viz therefore, thus, since, and, but, etc

   f) What should be done with material for the lower grades where lines are normally skipped.

   g) In general, should grade level considerations be made with regard to spatial arrangements.

   h) Could some of the material be placed on facing pages.

4. Is knowledge of the visual, spatial arrangement necessary for the student to achieve understanding and comprehension of the concepts involved.

C. Formulas and equations

1. Should formulas be treated differently with respect to their placement on the page and their spatial or linear character.

   a) Should formulas be represented in different ways according to the operations to be performed on them, e.g. fractions and cancellation both are represented spatially and linearly.

   b) Should the representation of formulas be considered on the basis of possible ambiguity or conflict with vocabulary of operations, e.g. for division of fractions, invert or multiply.

   c) Should the extent of formulas or equations affect how they are handled.

   d) How should embedded and isolated formulas and equations be handled.

2. How should successive terms of equations be vertically aligned. Should the inkprint be followed, e.g. alignment on the equals sign, or should some other form be developed.

   a) Should certain kinds of formulas be treated differently.

   b) Does alignment on the equals sign have any mathematical significance.

      i) Is the equals sign and alignment important to the solution of identities.

      ii) What should be done where expansion represents steps of an operation, e.g. the evaluation of exponents.

      iii) What should be done when the left hand terms of an equation remain the same.

3. How should runovers in formulas and equations be treated. (See Runovers, II A).

   a) Where and how should a division in equations be made.

   b) Should the number and size of links influence how they are divided.

   c) Where and how should the break be indicated.

   d) Where should the equals sign or any sign of comparison appear with respect to links ending or beginning a line.

4. What should be done with explanatory, or boxed, or reduced-type, multi-lined subordinate or accompanying formulas or material.

   a) Where should this material be placed.

   b) How should it be referenced.

   c) Is the transcriber's enlarged grouping symbol adequate for delineating this material.

   d) Should different types of material be treated differently.

   e) Should boxed material be enclosed. Could the enclosed material be keyed for the information it contains.

   f) How should formulas placed alongside a commentary or explanation be treated.

5. Where should reference numbers for formulas be located with respect to the formula. Should they be consistently placed on the left, right, or both sides of the formula.

6. Should a line always be skipped above and below formulas and equations or should the print practice be followed.

D. Displays for algorithms.

   1. The representations of all kinds of algorithms, such as the following, need to be studied for their readibility and an optimum format developed - addition, subtraction, multiplication, division, square roots, converting numbers in one base to numbers in another base, different types of equations, trigonometric identities, evaluation and expansion of determinants, binomial expansion, etc., etc.

   2. Should the form of presentation be linear-paragraph or spatial. Should the form depend on the type of material represented.

   3. Where should the material be placed on the page.

   4. How should steps and operations within the material be aligned. What should be done when parts or terms within the material are larger than other terms with which they are aligned and/or compared.

   5. How should lines and arrows in the material be represented. How should cancellation be represented.

   6. When large items or problems need to be carried over to another page where should the material be divided.

   a) Should different types of material be treated differently.

   b) Should the division be indicated.

7. What should be done with algorithms which are shown pictorially.

8. Should these problems be considered from the standpoint of education and grade level of the reader.

E. Determinants and matrices.

1. What is the most readable form for these arrays.

2. How should entries in the arrays be treated.

   a) Is the present form of left-justifying all entries the most readable and does it adequately cover all conditions.

   b) Presently, there are two ways of treating runovers of entries - (1) left justified with line skipped below and (2) indented with no space below. Is only one method needed. If so, which is the best; if not, could conditions of use be specified for each method.

   c) Is the present usage of braille ellipses the most discriminable and readable  Provisions are needed for showing vertical and diagonal ellipses.

   d) What is the best way of showing cancellation within these arrays.

      i) Provisions are needed for showing the cancellation of whole rows and whole columns.

      ii) How should vertical cancellation be indicated.

   e) How should arrows and other signs of operation within these arrays be shown.

3. How should arrays which are too large to fit on a single page be handled.

   a) Where and how should they be divided.

   b) Could a keying technique be used for the array and the entries. What would be the best type.

   c) Could some of the enclosing or grouping symbols be drawn in rather than using the braille configurations. What would be the best symbols for drawing.

F. Considerable work needs to be done on the readability of tables, their construction and contents.

1. Could tables be classified according to type and could their classification determine how they are displayed, linearly or spatially.

2. What should be done with triangular tables, time tables, multiplication tables, standard reference tables, calendars, etc., etc.

3. Should different rules be developed for volumes of tables compared with books containing only a few tables.

4. What should be done with small tables associated with graphs.

   a) Should they be placed above. below, or to the side of the graph.

   b) Should the table be vertically or horizontally arranged.

5. What should be done with large tables.

   a) Where and how should they be divided.

   b) Should the division be indicated.

   c) Do column headings need to be repeated.

   d) Could facing pages be used.

6. Should there be guidelines for the number of tables which can appear on a page.

7. Where should the table number and title be placed with respect to the table.

   a) Should they appear above, below or both, at the bottom of the page, centered or left justified.

   b) Should there be a space before or after or both.

   c) What should be done with runovers in long titles.

8. Should text material precede or follow a table on the same page. What should be done when a table runs across two or three pages and ends halfway down a page.

9. Should the practice of using single and double print lines to separate and distinguish parts or sections of tables be followed when using braille lines. Do the lines have a meaningful function besides that of esthetic appeal. Is their meaning the same in the tactual mode.

10. What is the optimum spacing between columns and between headings and rows. Should the spacing vary depending on the grade or developmental level of the reader.

11. What should be done with arrows, lead lines, tracker or tracer lines, lines showing missing data, and cancellation lines.

12. Under what conditions could or should col.umms and rows be transposed.

13. How should runovers of table entries be treated. Spacing would be a factor in this situation.

14. What should be done with references to footnotes within tables.

G. Exercises

1. For exercises having a number of parts, each with its own instructions, how should this contingency be handled.

    a) Should a space be skipped between the instructions and the exercises.

    b) Where should the two types of material be placed. Should one be indented, if so, which one.

    c) How should runovers of the materials be handled.

    d) What should be done when the instructions for the separate parts all precede the exercises.

2. How should long paragraphs within exercises be treated.

    a) Should they be indented beyond the functional margin; in what cell should they begin.

    b) What should be done with the runovers of the paragraph.

3. What should be done with exercises extending over a number of pages.

4. Should unnumbered or unlettered exercises be placed horizontally or vertically on the page. Sometimes the exercises are graded or ranked in some order - should different types of exercises be treated differently.

5. How should exercises which are numbered or lettered be treated.

    a) Should the designators be at the left-most margin with the material along a functional margin two cells in.

    b) How should short exercises or answers be set-out and designated.

        i) Should they be presented vertically or horizontally, and how should they be numbered or lettered.

        ii) Should different types of exercises be treated differently.

6. How should the answers accompanying problems be arranged and indicated.

    a) .Should they be positioned and labeled horizontally or vertically.

    b) Should the size or length of the answer determine their arrangement.

    c) Could guidelines be established for this situation.

    d) Where should the answers appearing at the back of books or supplements be placed.

       i) Should—they be placed at the end of the exercises or the volume in which they occur.

       ii) Should a note accompany the exercises telling where the answers are located.

H. Graphs, What should be done with graphs with and without grid lines.

    1. Central to their readability is the determination of the values referenced.

    2. Another important aspect of their function is the determination of the shape of the curve.

    3. What should be included on the graph. How much symbology (lines, points) can be used before readability is impeded.

V. Other Codes and Factors Needing Development.

A. Chemistry - a code is nearing completion in this area. Should it be evaluated for its notation, formats, and rules.

B. Symbology, characteristic graphics, and rules need to be developed for each of the following areas: Physics, Biology, Botany, Zoology, Astronomy, Statistics and Logic.

C. To what extent should codes be developed for the manifold areas of study - numerous new fields of study and endeavor are continuously unfolding. Could some conditions or specifications determine what areas should be encoded in braille.

Braille Codes Pilot Project

Outcome of Endeavors of Computer Committee


I. General Considerations.

A. The computer field is relatively new and rapidly changing. Changes
   are also occurring in the technology and hardware of computers.
   These factors should be kept in mind when the computer area is
   considered in connection with the Braille codes.

B. Considering Braille in relation to the computer field there are
   two general areas of interest - (1) the development of a computer
   code and (2) the translation of print into Braille by means of
   the computer.

C. With regard to the development of a computer code and, in general,
   other codes a number of considerations should be made.

   1. Because of the changing nature of the field one of the char-
      acteristics of the code should be expansiveness or open-ended-
      ness, and explicit provisions for this should be made at the
      outset.

   2. The task of developing a computer code is much too complex
      for part time efforts; needed are the full time endeavors of
      personnel hired for the purpose.

   3. How will the development of additional codes affect the num-
      ber of braille readers and transcribers.

   4. If more codes and hence a greater variety of materials were
      available would the number of users of braille increase.

   5. Should there be differences in code development, ways of
      presenting codes, etc. based on grade or developmental levels.

D. In the braille community there are considerable questions about the
   use of computers in the translation of braille.

   1. Regarding the computerization of braille it may be helpful to
      distinguish between complication and conflict within a code.

      a) The former refers to different procedures, rules, or al-
         ternative ways of transcribing which are sometimes complex
         and difficult, but for which conditions of use are speci-
         fiable. Involved are valuable techniques, nuances, etc.
         which should not necessarily be eliminated from the code
         because of complexity or difficulty.

b) The latter refers to procedures, directives, or rules which do not adequately differentiate under certain conditions and in given situations are incompatible or controvertible. These items should be eliminated from the code.

2. The computer can handle any kind of logical, unambiguous rules or functions for which an algorithm can be written. In practice, however, time and economics impose limits.

3. Some of the rules of the current braille literary code are ambiguous and conflicting. These require subjective judgment by the transcriber and are difficult for the computer to handle.

4. The techniques involved in using the computer to translate print to braille have influenced the literary code and should and will influence the development of codes in other areas. These influences will be of the nature of greater consistency and standardization.

5. Would using key punch machines instead of braillewriters make the transcriber's task easier and possibly encourage more persons to become transcribers.

E. The present project should consider the development of computer and other codes from the standpoint of eliminating the major problems. Fundamental issues should be resolved by whatever means are necessary. The braille authority computer committee considers their work developing a computer code to be interim and temporary. It was performed because something was needed and other resources were not available. Consequently they were willing to work within the limitations imposed by the present systems of braille. Now, however, with the prospect of greater resources more permanent, in-depth solutions should be sought.

F. A major problem in the field of computer codes and in other areas as well has to do with the lack of consistency and compatibility among the codes. Even more pertinent to the computer area is the transcription problem of when to use symbology from the computer code and when to use the symbology of the other codes.

G. An enduring and pervasive problem or question in all of the code areas concerns the degree of equivalence of braille and the ink-print copy.

1. Computer personnel require an exact duplication or isomorphism between the braille transcription and the ink print copy.

2. Those favoring the exact correspondence between braille and print appear to be those whose work or greater knowledge require a closer than average interaction with the sighted or sighted literature. Should there be different contingencies for these two somewhat different groups

H. The American Printing House for the Blind should take a greater leadership role in the study and production of braille and in effecting changes or innovations in the system.

1. Efforts and attention should be directed toward the production of fewer copies of a greater variety of books.

2. APH should make efforts to broaden its base of production beyond the secondary school level and to produce more scientific and technical literature.

3. Would increasing the present inadequate amount of braille materials for the professionals help to increase the number of braille readers.

4. APH should have a volunteer group of transcribers connected with its operations and should take an active role in directing these groups.

5. Correlatively, the Braille authority or some other group of individual needs to monitor on a frequent or daily basis problems with the codes and changes in print literature and to take immediate action. Procedures for developing and maintaining current standards can be obtained from the American National Standards Institute.

II. The Development of Expanded-cell Codes.

A. The rationale for an expanded-cell code.

1. Basic to all of the code problems and the computer translation of the codes is the multiplicity of meanings and the equivalence of symbols within and across codes. Many of the braille characters have more than one meaning, and, especially across codes, a number of characters have the same or similar meanings.

a) Related to this is the absence of compatibility of rules, procedures, etc. across codes.

b) Because of these conditions and the overlap of subject areas in texts the problem arises of when and how to use the different codes together. Furthermore, use of the codes together requires knowledge of the various codes and causes difficulty in reading and hand transcribing.

B. Questions and alternatives to an expanded code.

1. The variable width system should be investigated and evaluated for (1) the legibility of the characters singly and in combination, (2) the readability of words, phrases, and sentences, (3) the amount of changes required in the existing systems, and (4) its overall feasibility.

2. Is an all embracing code desirable from the standpoint of the present Math and Music codes and the material available in these areas, the habits, attitudes and type of the consumer, the possible greater amount of material to be learned, and the equipment and writing devices currently used.---

3. Would the variable width code make the existing codes simpler or more complex in terms of symbol units, rules, etc.

4. How would the proposed code affect the number of symbols per line and the amount of material per page. How would tables, charts, etc. be affected.

5. How would the variable width code affect learning to read and reading behavior in the lower grades. What affect would it have in the later grades and on those adventitiously blinded.

6. Inasmuch as the principal source of conflict or problems stems from the relationship between the Math code and the emerging computer code could these differences be resolved and would this constitute an acceptable alternative to the variable width system.

III. The Development of a Code for the Computer Field.

A. General

1. The things which need to be considered in developing a computer code are those which have already been reviewed and worked on by the Braille Authority Advisory Committee, i. e. the development of notation, methods for handling special displays, and rules for use of symbols and formats.

   a) According to the committee there is nothing especially unique about code development for the computer field except for special symbols and some displays which are not much different from those encountered in other fields.

   b) In comparison with some of the other braille codes the computer code has a restricted audience or limited interest and should be considered as a subset of another code, most likely the Mathematics and Science code. On the other hand, the computer code has broad applications and its importance and use will increase considerably in the future.

2. To resolve these problems an overall code containing a large number of symbols is needed to embrace the different subject areas where separate codes now exist.

3. One way to obtain more discrete symbols is through an expanded-cell construction.

   a) In this regard nine-dot braille has recently received some attention, however, the number of available characters in this system is too limited to take care of the vast number of different print symbols.

   b) A more workable system, and one recommended by the committee, is a variable column width construction which is similar to the Standard Dot System proposed by the Uniform Type Committee in 1915 and, with the exception of cell height, the old New York Point System

      i) With the variable width system there are more than enough discrete symbols to take care of the separate codes which now exist.

      ii) With the proposed system the symbology or notation of the present literary code could remain much as it is, only minor changes being required.

      iii) Where the most change in the present literary code would occur, is in the spacing between characters and words. Overall, though, the number of characters per line would be approximately the same. The change in spacing would also require a change in the writing devices: for the braille writers and stereograph machines it would be only a minor modification, for the slates it would be a design similar to that formerly used for New York Point.

      iv) Further, concerning devices and machines, if unambiguous and consistent codes or a code is available then the technology and equipment - writers, reading machines, etc. - will develop.

4. It is also possible that with technological developments something such as interchangeable ratchets on braillewriters would preclude the change in spacing and the literary code would be, for the most part, as it is.

5. To assure an objective consideration of the variable width system the computer committee would like to disseminate examples of the code and to hold a meeting of the other committees and individuals interested in the development of braille.

c) The big problems for the computer code and other codes
as well, which have already been mentioned above, are those
of deciding when to use the different codes and the multiple
meanings and the variant uses of the characters.

2. A listing of some of the more specific problems encountered
in developing a computer code follows.

a) In computer manuals two types of alphabets are frequently
used to provide different kinds of information, e. g. to
show the interaction between the operator and the machine.
How should this situation be represented in braille.

b) Relatedly, different print type fonts are used to distin-
guish between reserve and variable words or expressions
in the computer language. How can this distinction be
made in braille.

c) In computer materials there are many different forms and
uses of capitalization which are important to various
operations and functions. This matter needs to be researched
in whole and provisions made for its manifold forms.

d) The above three problems are also applicable to the general
problem of different type fonts and variant print forms
in other areas. (See Textbook area - ill E)

e) What portion of text material should use the computer code
notation and what parts should use the literary and Math
codes notation.

   i) It is generally agreed that the listing of prog.ams
   and displayed coding sheets should be represented
   in the computer code. Are there other distinctive items
   for which a certain code can be specified.

   ii). What should be done when a computer word or expression
   is embedded in a different text. Can the conditions
   be specified under which this situation can be handled.
   What should be done when computer materials appear in
   lower level (high school) textbooks.

   iii) Should a rule be developed specifying that computer
   manuals are nonliterary and therefore would use computer
   notation and punctuation.

3. The different languages in the computer field present different
problems with respect to the development of a computer code.
Provisions need to be made for these systems.

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4. A number of problem itesm which have caused difficulty for
the computer in the translation of braille codes have been
identified by the Advisory Committee of the Braille Authority
and Messrs. Robert Haynes and John Siems of the American Printing
House for the Blind. These constitute general kinds of problems
or factors to be avoided in the development of a braille code.

B. Computer notation or symbology.

1. The advisory committee has developed braille notation for
close to 80 print computer symbols. This list is not exhaustive
and the search for other symbols should be continued. The
braille representations should also be evaluated for legibility,
optimum assignment, etc.

2. For information about symbols which need to be encoded and to
determine whether the present notation is adequate an investi-
gation should be made of pertinent publications of the American
National Standards Institute, Inc., 1430 Broadway, New York
10018.

3. Because of the large number of print symbols to be encoded many
were represented by two-cell braille characters. Do the assign-
ments that were made conflict with the two cell contractions
and short form words of the literary, math and chemistry codes.

4. Some of the print symbols have certain structural characteristics
which provide information to the reader; should an attempt be
made to maintain these characteristics in the braille represen-
tations.

5. Since alignment is often important in computer materials, how
can it be achieved in light of the fact that some print symbols
are represented by one-cell braille characters and others by
two-cell characters.

6. Often more symbols per line or a line wider spaced than what
is currently used is needed. Could the APH produce a 40 or 41
cell line since the current standard of 38 is primarily a convention.

C. Displays used in computer field.

1. The problems with displays and the displays found in the com-
puter field are not unique. They are reducible to the more
basic issue of making two and three dimensional print displays
tactually meaningful. However, there are some displays which
occur in this field with considerable frequency and for which
formatting procedures need to be developed and investigated.
Some of these are flow charts, punched cards, decision tables,
etc. (See Maps, Charts, Diagrams Area).

a) Most of the displays found in the computer field are currently represented in a tabular form. Could a more meaningful or readable representation be found for these different types of displays.

b) The Braille Authority advisory committee has developed a method for presenting flow charts. So also has the Medcomp Corp. of Cincinnati, Ohio. How do these two approaches compare. Which is more effective and applicable to the range of flow charts found in the computer field. See Appendix B.

c) How can punch cards and their contents be represented in braille. A one-to-one relationship needs to be maintained between the data on punch cards and coding sheets. How can these displays be represented so that the identification of the cards and contents is optimum and the columnar location can be determined.

d) How should tree diagrams be represented. Since order is important in traversing these figures could provisions be made for the different forms of progression.

2. In the production of these figures should a standard method be developed. Is a standard method--possible for the different types of media (paper and plastic) and the different production processes (braillewriter, thermoform, and press).

3. To accompany the study of these displays there should be efforts directed toward the development of tools for their production.

IV. The use of computers in translating braille codes.

A. General

1. The prospective or future use of computers in translating all of the braille codes should be a basic consideration to their study and development.

2. It was proposed that in the future computer translation of braille will be commonplace and the answer to the problem of shortrun materials for public school children and other special groups.

3. In developing a program to translate a braille code there are many ways to proceed, however because of production problems which are not necessarily evident in the program phase there should be either a close alliance between the developer and the eventual producer or the producer should develop the program.

B.   Problems encountered by computers or transcribers in translating codes.

1.   The rules of the literary and other codes need to be examined for ambiguities, inconsistencies, etc., which are non-essential to the functioning of the code, and these factors changed or eliminated. The examination should be made both within and between codes.

2.   The advisory committee and computer staff of APH have identified problems and made recommendations to the Braille Authority about difficulties encountered by the computer in translating the literary braille code. These are representative of problem items that would be encountered by the computer in translating any braille code. See Appendix A, Parts 1 and 2. Most of the problems are based on variable use of code elements contingent upon pronunciation, meaning, or position in words, sentences, or lines. To resolve most of these problems human intervention is required.

3.   Other problems concern math code functions.

a)   To avoid conflict the numerals of all codes should conform to those of the Nemeth code even though this would necessitate the use of special indicators or some changes in the other codes.

b)   Use of Nemeth code signs for some mathematical operations was suggested for the literary code. Signs which could be used and require no changes in the literary code are $+$, $-$, $\times$, $\div$, $\$$, $\cent$, $\%$, $=$, and the parenthesis sign.

V.   Individuals and organizations working in the computer field.

A.   The individuals and developments listed in this section are not meant to be exhaustive, but merely provide a starting point for obtaining information about the area. In addition to the persons listed are those who served on the committee which provided the material for this report.

B.   In developing programs for computer translation of braille or determining the potential for such development a number of individuals and organizations have been involved.

1.   Mrs. Ann Schack worked on the original IBM 704 program for the Literary code.

2.   Mr. John Siems at APH has subsequently worked out an efficient assembly language program for the Literary and Textbook code on the 7040 IBM computer.

3. Mr. Edward Glaser and Dr. Kenneth Ingham have independently worked on Grade 1.8 Braille programs for use on smaller computers. Grade 1.8 is not an official code and is so designated to indicate that fact. This code uses the contractions wherever they occur.

4. The Massachusetts Institute of Technology is working on a Cobal program for good Grade 2 Braille. This program does not have textbook capability.

5. Mr. and Mrs. Joseph Schack conducted a feasibility study of a computer translation program for the Music and Math Codes. Their findings were positive, and they subsequently submitted a proposal for the development of a program to translate the Music Code.

6. Messrs. William Watkins and John Siems at APH are working on a one year project to develop a computer assisted braille music translation program. The project will be completed in the summer of 1972.

7. Mr. Robert Gildea of Mitre Corporation is preparing a project description for the development of a computer translation program for the Math Code.

8. Argonne Laboratories is working on a code system which will operate a reading device. The system is to be complete in that it will read, translate, and provide output.

C. Dr. Charles Hallenbeck at the University of Kansas has developed a program which uses the computer line printer to produce different textured tactile displays.

D. Similarly, Mr. Sam Mason at MIT has developed a computer-controlled device for producing tactile pictures called the "Picture Brailler".

E. For braille output devices a number of organizations and individuals have developed either consoles or computer attachments which produce either modified Grade 1 Braille or a regular Grade 2 Braille. Among them are the Honeywell, IBM, Teletype, and Phylab Corporations, MIT/Mitre, Mr. Ray Morrison and Mr. Guy Carbonneau.

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Braille Codes Pilot Project

Outcome of Endeavors of Maps, Charts, Diagrams Committee

I.  General Considerations

A.  Over the years there has been little change in the production
of maps by publishing houses; only within the past five years,
approximately, have new procedures been tried, but, in the main,
without a reliable evidential basis.

B.  On the whole, the principles and laws of visual perception apparently
do not apply to tactual perception.

1.  Compared with vision tactual perception is more restricted,
less sensitive to detail, and has more of the quality of
serial integration.

2.  Some material cannot be represented in a way which is tactually
meaningful to most readers, e. g. three dimensional drawings.
Other alternatives need to be investigated.

3.  More information is needed about tactual perception. Principles
need to be developed which will define the tactual perception
of patterned displays.

C.  Integral to the study and development of tactual displays is the
experiential level of the reader.

1.  Affecting the perception of symbology and displays is the
reader's developmental age and his previous experience with
the symbols and displays.

2.  Advancement in this area has been retarded because of the
absence of training in reading tactual displays as well as the
lack of knowledge of perceptual factors - future work in this
area should proceed along the lines of parallel development
of these two aspects of reading displays.

D.  Inasmuch as most visual maps are generalized or distorted to de-
lineate important landmarks there is no good reason why tactual
maps should not be distorted to make them more tactually meaningful.

E.  In reproducing tactual displays, principally maps, volunteer
transcribers are forced to make decisions about a number of factors
which, for the most part, they do not have sufficient information
to resolve. Answers to questions such as the following are needed
by the transcribers.

    1. Will the display be tactually readable or meaningful.

    2. Could it be made meaningful and how.

    3. How long would it take the reader to interpret and under-
       stand the graphic.

    4. Has the map already been produced and is it available elsewhere.

F. In the production of tactual maps consideration should be given to
making the maps useable by the partially sighted. In doing this, prac-
tices appropriate to the two modalities need to be compatible.

G. There is a need for guidelines for the production of tactual displays,
and possibly there should be two sets of guidelines, one for volun-
teers and one for publishing houses.

H. An outcome of future studies of tactual displays should be a manual
or manuals on their production for transcribers and other producers.

I. Consideration should be given to having standard, commonly occuring
maps designed and produced by professionals, possibly at a central
agency.

J. Surveys, or studies should be made of persons skilled in the pro-
duction of tactual graphics for a description of symbology,
techniques, etc. which they use. Similar studies should be made
of skilled users for a delineation of features, relationships, etc.
of displays which contribute to readability.

K. Research on tactual displays should be conducted solely from the
standpoint of their maximum readability.

II. Perception of symbols

  A. General

    1. More symbols of different types are needed - efforts should be
       made to determine what is available and to develop others where
       necessary.

    2. Symbols should be studied individually and in combination:

       a) To determine their discriminability.

       b) To determine the characteristics or features which make
          them distinctive.

       c) To determine their facilitation or inhibition on the per-
          ception of one another.

3. In studying symbology the effects of grade level and developmental factors should be determined.

    a) Are some symbols indiscriminable until a certain developmental level is reached.

    b) Could different principles be developed for distinct processes at different levels.

4. How is the perception of symbols influenced by training at different grade levels.

5. Most of the research work on symbols has had to do with their discriminability. Other studies need to be made of the identification and recognition of symbols.

6. Studies should also be made of the storage or memorial processes influencing retention of the symbol patterns. What symbols are easily stored or remembered.

B. Types of symbols

1. Point, line, and areal symbols which have been found to be discriminable in different studies should be brought together and further study of the discriminability of the larger groups of symbols should be made. Could groups of these types of symbols, discriminable within the groups, be established.

2. For optimum legibility how should these symbols be placed in relation to one another. How should they be placed in relation to braille symbology or writing.

    a) How does their orientation separately and in relation to other symbols influence their legibility.

    b) How much space should separate different types of symbols.

    c) How much space should separate intersecting symbols.

3. Some symbols or figures are more salient or legible than others, e.g. triangle, square, etc. What are these symbols and could they be ordered or ranked according to their legibility.
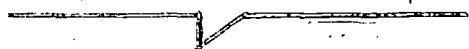
C. Characteristics of symbols

1. What are the features or characteristics of symbols which made them discriminable, identifiable, and recognizable. Do the features or characteristics vary contingent upon the process involved.

2. Symbols can differ in shape or form, size, texture, and height or elevation.

   a) Along one dimension how many absolute discriminations are possible. For combination of dimensions how many discriminations are possible.

   b) Would symbols appearing at different elevations be sufficiently discriminable to be useful in displays. Could an optimum order of types of symbols at varying elevations be established.

   c) Concerning shape or form differences among different types of symbols is there only a small number that can be reliably distinguished from one another.

3. The managed use of redundancy of information in symbols and figures should be studied, e.g., how would encoding symbols by shape and texture influence their elgibility.

4. Can certain figures or forms be perceived as well when represented as an outline as when they are represented as a raised surface. Would the same relations maintain if the line forms and surfaces were of different textures.

D. Functions of symbols

   1. Should symbols be collected, developed, and standardized for different purposes.

   2. Could different symbols have certain functions relative to the correspondence between their structural characteristics and what they represent.

   3. Are some intaglio symbols sufficiently legible to be used in tactual graphics.

      a) Could they be used to represent waterways, rivers, shorelines, etc.

      b) One such symbol which has been used and have proven legibility is the following:

   4. Could symbols have conventional functions or assignments across areas or subject matters.

III. Perception of displays

A. General

   1. To be able to perceive displays, prior experience with spatial relationships and with elements similar to those of the display is needed. In other words tactual learning and development must be considered. What types of learning and experiences are important to the ability to perceive displays.

2. What are the behavioral tasks of reading displays both from the standpoint of reading and from the standpoint of executing objectives.

3. What are the most efficient types of scanning techniques or strategies. Do these depend on the purpose of the reader or task and the type of display.

4. To reflect on the important characteristics of displays could correspondences between the mental maps of readers and the displays be determined. What does the reader remember of the display.

5. Could different types of displays be classified and studied to determine those which are most readable from which characteristics contributing to readability could be discovered. Could the information which is retrieved be compared with that which is displayed or supposed to be acquired

    a) Visually length, area, and volume of figures within some displays are readable in that order. In what order would these dimensions be read tactually.

    b) What are the unique features of each of these dimensions which make them readable.

6. The relationships between the figure and ground of tactual displays needs to be studied - the application of visual principles may result in reversing the relationship in the tactual mode.

7. What are the variables influencing the perception of organized or patterned displays. Needed are psychophysical studies showing the tactual ability for pattern resolution.

    a) What are the conditions for obtaining figural unity in a tactual display - in vision depending on certain relationships elements of a figure hang together

    b) What are the conditions for obtaining figural separation in a tactual display

        i) How does the reader know which elements belong to which figures

        ii) How far separated must figures be before they are perceived as distinct.

8. Needed is a consideration or determination of the physical limits of symbols within organized displays - size, number, number of different types, spacing, etc

9. Would the inclusion of reference points and other orientation symbols or devices aid the readability of displays.

B. Size

1. What is the optimum size of tactual displays - maps, figures, diagrams, etc. What are the factors which determine that size.

   a) Needed are studies of the areal extent of figures from the standpoint of serial perception and subsequent integration.

   b) How small could the figures be without violating the requirements for pattern resolution. Are there optimum conditions for this situation.

   c) Is there an optimum relationship between size and the amount of information to be conveyed.

   d) Is the best size for a display that which is kept within a two-hand span. When reading a display does separation of the hands interfere with distance judgment.

   e) How does the size of a display affect the reader's frame of reference.

   f) Does the size of a display vary according to the grade or developmental level of the subject.

2. Presently maps are produced in large atlases - would they be as readable if they were the size of a braille page.

C. Number of complexity

1. Displays should be kept as simple as possible. What is simplicity and how simple should displays be.

2. What are the factors which contribute to the complexity of displays.

   a) What constitutes an optimum amount of information, number and kind of symbols and number and kind of figures which can be depicted in a display. How many different types of symbols and figures can appear on a display before legibility is affected.

   b) What makes a display too cluttered to be readable. This factor should be considered in relation to, or in conjunction with notes, labels, lead lines, tracker dots, etc.

c) Is there a developmental or learning factor related to complexity or the amount of information in a display.

3. According to cartographers only around five point symbols are needed for a map. Could the numerosity of different types of symbols used in different types of displays be determined.

4. A procedure for determining where difficulty is encountered in displays might be to start with simple figures and add on information until performance or readability deteriorates or breaks down.

D. Scaling

1. There are two aspects to scaling - one refers to the actual construction, the size-distance relationship between parts of a map and other figure; the second refers to the perception of the time-distance relationship between parts.

a) In terms of the first aspect could the value of scaling be determined for different types of tactual graphics, e.g., visual maps are distorted for emphasis

i) What is the significance of scales used.

ii) In this sense should scaling in some displays be considered anything more than a general indicator for comparison purposes.

iii) What should be done when the scale of a figure has to be changed for braille and operations involving the scale are required to answer questions about the figure.

b) Scaling in the second sense is one of the most important aspects of interpreting any graphic.

i) What are the factors which are related to the perception of these relationships.

ii) What kinds of experiences or training are necessary and related to this ability.

2. Tactual scaling needs refinement and development for the following items: thermometers, clocks, rulers, protractors, money - anything comparing or showing the relationship of values.

3. Closely related to scaling is orientation to the placement of figures and orientation to compass directions.

a) How should these things be indicated

b) What are the factors which influence or contribute to orientation.

IV. Descriptive or explanatory material

A. Where and how should the title, instructions, explanatory material, notes, keys, labels, and compass directions be placed in relation to the display and the page.

1. Could the arrangement of these items always be the same; could standard conditions be determined for them. Under what circumstances should they differ

2. Should titles, labels, etc be placed both vertically and horizontally on the page. In which direction would these items be more readable.

3. What kinds of symbols should be used for the compass directions.

4. What should be done with leaders from a label to an indexed part. Could conditions be determined under which they would improve readability.

5. Does labeling or other extraneous symbology within a textured area cause confusion in perceiving the area.

6. Key placement

a) In arranging the key symbology consideration should be given to whether their orientation is the same as used on the display. How would a change of orientation influence the perception of the symbols

b) In multi-sectioned displays or displays running across more than one page, should the key appear only once or be repeated for each section or page.

B. Under what conditions should number and letter signs be used. Should they be used at all. There are different practices of using these symbols - should their use be standardized.

C. How should different ink colors and shading be represented.

1. What should be done with different saturations of hue.

2. Could different textures be used for shading.

V. Training for reading displays.

A. Children need to be taught to systematically explore tangible displays. For efficient performance children need to develop strategies for exploring displays.

B. Children need to be taught a wide variety of spatial relations.
Are some types of tasks and materials better than others for achieving
an appreciation of spatial relations:

C. Readers need to be taught the concepts and practices. of scaling
and these related to the child's actual experiences.

D. What do teachers think are important features of displays and
aspects of reading displays which need to be taught. Could an
assessment or survey be made of teacher's interpretations of these
things.

E. Training to read displays should be gradual and should increase in
complexity as grade level or age increases.

F. In terms of skills, principles, and techniques what would be
appropriate for training teachers in the area of reading displays.

G. Should manuals for reading displays be developed for teachers and
students.

H. One area where displays and training for reading displays is criti-
cally needed is that of Orientation and Mobility. Here maps are
needed for different grade or developmental levels.

VI. Classification of displays:

A. General

1. Would the classification of displays and maps provide informa-
tion which would be relevant to perception. Could the kinds of
information displays are supposed to contain be classified.

   a) Do the types and characteristics of displays interact with
   characteristics of tactual perception or other characteristics
   of readers.

   b) For classification of different types of maps see Robinson
   and Sales - Elements of Cartography. Could base maps be
   prepared for different types of commonly occurring maps.

   c) Should certain types of maps contain information based on
   certain principles or purposes for which they will be used,
   such as specific utility, e.g. in a layout of a floor plan
   for a building show only main corridors, directions, stairs,
   and their direction, location of important offices and
   restrooms.

   d) What displays are easiest to read both between and within
   classes and what are the factors contributing to their
   readability.

B.  Different types of displays.  The following are not exhaustive but simply the ones considered by the committee.  For other examples and considerations see the Textbook and Math areas.

1.  Biological and Botanical drawings.  These need classification and some should probably not be attempted at all, others could be treated with cross sections and graphs...

2.  Circles and pie diagrams.

    a)  To make the comparison of areas of circles visually accurate, the circles need to be corrected by a predetermined amount.  Would this also be true for the tactual mode.

    b)  How should they be divided in order for the divisions to be tactually readable.

    c)  Could circles be used to develop the concept of degrees of angularity.  Is this an efficient means of teaching degrees in angles.

3.  Clock faces and thermometers, both actual devices and representations.

    a) The main problem with these devices is that of comparing a moving point with a fixed position or positions.

    b)  What is the optimum space between the pointer and the index number.

    c)  What is the optimum space between the index numbers.

    d)  What is the optimum length of hands which will allow them to be differentiated.

    e)  In studying these devices should a distinction be made between static teaching models and dynamic actual models. Different considerations need to be made for circular and bar type thermometers.

4.  Crosscuts or cross sections

    a)  For example, biological or geological - these types of figures should be considered or treated with line graphs.

    b)  Would overlays or serial drawings depicting different features of the same object be an efficient means of representing these figures.

5. Economic charts. What could be done with cartograms in which pictures of actual objects are used to show the function. Should other symbols be substituted for the figures.

6. Electric l or electronic schematics.

   a) Symbology and uniform method of representing are needed.

   b) Would outlined blocks enclosing symbols which have been keyed be an effective means of representing.

   c) Would a narrative description of the schematic be as meaningful as a spatial representation.

7. Flow charts.

   a) Do the different kinds of flow charts present different problems.

   b) Should special symbols be developed and standardized for boxes, slopes, directional lines, branching, etc.

8. Graphs, bar and curve.

   a) Three principle problems are the detection of the slope of a line, the relationship of values or classes of values, and the referencing or determination of values. What are the variables which influence these functions.

   b) Could standards be developed for setting up the axis lines of graphs. For a series of graphs would maintaining the same basic axes contribute to readability.

   c) For bar graphs is the outline form as readable as a raised surface bar. What about straight lines as substitutes for the bars.

   d) Is there an optimum elevation and spacing of cross hatching and leader lines which would not interfere with the legibility of the graph.

   e) Would alternative ways of presenting the information in some graphs. e.g. tabular format, be more efficient. Under what conditions.

9. Pictures, figures, and photographs of objects.

   a) What should be done with items of this nature which cannot be reproduced. Should they be described. If so, is the description and vocabulary level adequate.

b)  Should an attempt be made to develop tactually readable,
    simple embossed pictures and shapes of commonly occurring
    objects

c)  What should be done with pictures and drawings that figure
    into different types of operations and functions within
    the text, e g. in math, counting pictures of elephants,
    cowboys, etc.

d)  Should different procedures for handling these materials
    be developed for different grade levels.

10. Rainfall maps

a)  Would different textures and density of patterns adequately
    depict the information involved

b)  Could different symbols be used for different types of
    information

11. Time lines

a)  Two sources of difficulty with these figures are referencing
    time values and overlapping time periods. What could be
    done about these problems

b)  Could different degrees of line symbol legibility be used
    to depict different time periods. This would require scaling
    of line symbols.

c)  How should direction of time lines be represented.

VII. Production

A.  What are the principles on which transcribers and others rely
    to produce displays

B.  In terms of faithful reproduction of the object or event, how
    accurate does a display need to be to convey the desired concept

    1.  Could features of displays be distorted to emphasize important
        information.

        a)  Would distortion result in a more accurate percept

        b)  Would it lead to the desired percept more quickly.

        c)  Under what conditions should it be used.

2. When would generalizing (excluding insignificant detail and elaborating important elements) of displays be useful Under what circumstances should it be used; for what purposes.

C. Would serial drawings depicting different features of the same display improve its readability Is the reading of displays divided into sections more difficult than reading the whole display

1 Is the skeleton procedure (presenting a bare outline of the whole display and subsequently elaborating subsections) an effective means of representing displays

a) How should the skeleton be divided - would quadrants be the most desirable

b) Should the complete display accompany the skeleton Where, before or after

2 In partitioning displays would it be better to add or subtract layers of complexity Should the whole figure precede or follow or come before and after the partitioning

3. Would these procedures produce the same effects on subjects at different grade or developmental levels.

D. Could methods be worked out for representing three dimensional objects or figures in a two dimensional tactual space Are there current methods for doing this and how effective are they.

E. What considerations should be made regarding multi vs single copy reproduction and the different types of media on which the displays are produced - plastic and paper

1. Should there be different principles of production for these different conditions Should the production process depend on these variables

2 Are there certain types of materials which are best for certain types of displays

3. For different types of media such things as the following should be considered: capacity for texturing, ability to hold the pattern, strength of pattern, longevity of material.

4. Do different types of symbols need to be developed for the different media Could certain of the same symbols be used across the different media

F. Could the use of symbols be standardized For different types of displays.

1. Are there a sufficient number of symbols to standardize

2. Could production conventions for the use of symbols be developed.

3. Would standards produce limitations on the use of symbols and the production of displays.

G. Could overlays and facing pages be used and be tactually meaningful.

H. Tools need to be developed for discriminable symbols and the production of displays.

1. Should they be standardized for different types of production processes, for different types of material.

2. Would a plate or template for drawing against be useful in conjunction with some of the tools

3. Would computers be useful or have any application in the production of tactual graphics

4. Can the tools be produced economically, can they be made on a production basis

VIII. Individuals and organizations involved in the study and production of displays

A. The following items are not exhaustive of the many individuals and organizations working in this area. They are references adduced during the committee meetings. As references they furnish a good starting point for investigating the area. Naturally, heading the list are those individuals who served on the committee and provided the substance for this report

B. Dr. Alfred Leonard at the University of Nottingham has studied the physiological correlates and behavioral tasks involved in using maps for traveling

C. Dr. W. James Pickles, Worcester College for the Blind, has done considerable work on training to read maps.

D. Mr. Robert Gunderson, New York Institute for the Blind, is skilled in the production and use of electrical schematics and Morse Code.

E. Mr. Carlton Martin, Wichita, Kansas, has designed and developed embossing tools for Mrs. Betty Epstein, a volunteer map transcriber.

F. Rand-McNally has published a map reading training text for teachers and one for students.

G. The Army Topo Command, Washington, D. C., has done considerable research on maps and work on the production of maps - equipment, materials (the latest in plastics) and techniques. This organization may have available pantographs which would be useful in the production of maps for the blind.

H.  Expandocraft paper made by the Scott Paper Company allows greater
    elevation of symbols and may be useful in the construction of
    displays.

I.  Tedlar PVF film is a thin sheet of plastic on which one can mark
    and obtain a raised image on the same side of the sheet as that
    on which marked

J   The Massachusetts Institute of Technology has worked with a chemical
    process for etching plastic which reportedly results in a very
    legible tactual graphic

K.  The Howe Press, Royal National Institute for the Blind, and Re-
    cordings for the Blind have all wroked on and produced tool kits
    for the production of tactual displays

Appendix D

Generalized Problem List


        The following report is the result of an attempt to bring together
and relate problems and issues from five areas where work on braille codes
is necessary.  The first section contains general considerations brought
up by committee members in each of the areas.  No attempt was made to indicate
the areas in which the issues arose.  In subsequent sections, 2.0 through 5.0,
individual problems are specified and the areas to which they relate are in-
dicated.  The indicators are found to the right of the problems in any of
three columns.  The columns are headed by letters which refer to the following
areas:  TF - Textbook Format, Mu - Music, M & C - Mathematics and Computer.
Within the M & C category most of the items are from the math area.  To dis-
tinguish these from ones in the computer area, the fewer number of computer
items are preceded by COM.  Also included in this category are a very few items
from the Maps, Charts, and Diagrams area.  These are preceded by the word,
Maps.  The symbols found under these headings refer to problem items in certain
sections of the committee reports for each of the areas.  The committee reports
were set up in a standard outline form using Roman numerals, letters, and
numbers.

Braille Codes Pilot Project


1.0   General Considerations

  .1   Common across areas

  .11   Philosophy of transcription
  .12   Considerations basic to problems
  .13   Modification and development of codes and techniques
  .14   Editing
  .15   Considerations pertinent to transcribing
  .16   Considerations involving computers
  .17   Manuals and guidebooks
  .18   Considerations concerning the American Printing House for the Blind
  .19   The development of an overall code of braille

  .2   Specific to areas

  .21   Textbook Format
  .22   Mathematics and Science Area
  .23   Music Code
  .24   Computer area:   code development
  .25   Maps, Charts, and Diagrams area

2.0   Problems of Symbols and Rules Involving Symbology

  .1   Review of symbology and conditions of use
  .3   The representations of symbols
  .4   The placement, arrangement, or alignment of symbols
  .5   Other symbology needed

3.0   Formats and Linear Displays

  .1   Formats

  .11   Formats for different parts of a book
  .111   The cover and volume identification
  .112   Title pages
  .113   Indices
  .114   Appendices
  .115   Glossaries

  .12   Formats for page variations
  .121   Pagination
  .122   Numbered and lettered lines including those which are to be counted or
         otherwise reckoned and measure numbering
  .123   Page titling and key and time signatures
  .124   Alignment and juxtaposition of materials
  .125   Runovers, word and measure division
  .126   Margins
  .127   Footnotes, references, marginal information, and glosses
  .128   Transcriber's notes
  .129   Variant type forms and print devices for emphasis

Braille Codes Pilot Project

1.0  General Considerations

.1  Common across areas

.11  Philosophy of transcription.

Some of the items within this report are posed as questions, some as
statements, all represent considerations or judgments by members of
the committees about what needs to be done to improve braille and the
plight of the braille reader.  Not all of the considerations were intro-
duced by committee members in all of the areas but occurred with greater
or lesser frequency.  Those items under general considerations are not
designated according to the area from which they came.  The ones under
the more specific problem sections are so designated, and an attempt
was made to generalize the items across areas.  To determine the exact
problem for a given area, it is only necessary to refer to the committee
meeting for that area.
The items included in this subsection are not the only ones which are
pertinent to a philosophy behind the translation of print to braille.
Many of the considerations and questions from other of the subsections
below are also applicable.  The reason for singling out the ones in
this section was that so many of the problems listed later had their
origins or solutions linked to them.

.111  An enduring and pervasive issue in all of the code areas concerned
the degree of equivalence of braille and the ink print copy or, in
other words, isomorphism versus divergence.  This issue arose in all
of the areas, and those from the computer and math fields favored the
exact correspondence.

.1111  Empirically those favoring the exact correspondence were those whose
work was technical or such that required a close interaction with the
sighted or sighted literature.  Should different contingencies be
considered for these somewhat different groups.

.1112  In what ways is it important for the student to know how the print
format appears  Should a grade level factor enter into this question.

.1113  What considerations relevant to the equivalence issue should be
made regarding visually handicapped students in public schools.

.112  Another factor arising in a number of the areas, albeit at times only
implicitly,concerned the unit of recognition in braille reading.  It
was apparently assumed that this unit was the whole word, and that
braille reading occurred in a manner similar to print reading.  The
effects of this assumption on the codes are the establishment of rules
and practices whose purpose is to maintain the integrity of the whole
word.  However, research has indicated that the unit is the individual
character which along with the other characters in a word is sensed
in a spatial-temporal sequence.  These results have implications for
the use of contractions in words and the division of words.

.113.  Another issue which arose in all of the areas was that space saving
is no longer the important consideration it once was, and now greater
emphasis should be placed on the readability of braille.

.114    One further item for consideration was that an attempt be made to
        determine the tactual meaningfulness of changing print practices, and
        that research and changes of the code should be based on maximum
        readability.

.12    Considerations basic to the problems.

.121    Overall the principles and laws of visual perception do not apply to
        tactual perception.
.1211   Compared with vision tactual perception is more restricted, less sen-
        sitive to detail, and has more of the quality of serial integration.
.1212   Some material cannot be represented in a way which is tactually
        meaningful to most readers, e.g. three dimensional drawings.  Other
        alternatives need to be investigated.
.1213   More information is needed about tactual perception.  Principles need
        to be developed which will define the tactual perception of patterned
        displays.
.122    Integral to the study and development of braille and tactual displays
        is the experiential level of the reader.
.1221   Affecting the perception of symbology and displays is the reader's
        developmental age and his previous experience with the symbols and
        displays.
.1222   Advancement in this area has been retarded because of the absence of
        training in reading tactual displays as well as the lack of knowedge
        of perceptual factors - future work in this area should proceed along
        the lines of parallel development of these two aspects of reading
        displays.
.123    A major problem in all the areas has to do with the lack of consistency
        and compatibility among the codes.  Of possibly even greater significance
        is the transcription problem of when to use the symbology of one code
        and when to use the symbology of the other codes.
.124    In planning or considering codes for different fields some variables are
        common across all fields - vertical and horizontal factors.  An attempt
        should be made to make codes compatible horizontally or where they
        share commonalities and avoid having different symbols for the same or
        similar situations   This requires the determination of common elements.
        Would a computer be useful in listing or keeping track of instances
        where symbols or rules are used.
.125    The present project should consider the development of computer and
        other codes from the standpoint of eliminating the major problems.
        Fundamental issues should be resolved by whatever means are necessary.
        With the present prospect of greater resources more permanent, in-
        depth solutions should be sought.
.126    In dealing with the problems a useful distinction may be that between
        format problems and problems of linear and non-linear displays.  The
        latter problem types refer to relationships of parts internal to an
        item such as a table or graph, and the former refers to relationships
        of the text to the page and to other items on the page.   This dis-
        tinction is followed later in the sections dealing with the more
        specific problems.
.127    Decisions concerning problems in the present code should be made in
        light of eventual computerization and standardization of practice.
        On the other hand, any changes in the code should be made from the
        standpoint of the reader and a workable code and not ease of computerization.

.13 Modification and development of codes and techniques.

.131 The present practices and rules of the codes need to be examined
and evaluated, and the inconsistencies within and across codes
eliminated

.132 Within a code some of the symbolism may be deleted but there is a question
of whether or not new meanings should be assigned to the characters
formerly used.

.133 Format techniques and rules should be looked upon only as guidelines
which may change with future developments.

.1331 Practices and rules should be kept current with changing print
practices.

.1332 Maintaining currentness is an ongoing process and requires continuous
monitoring of print and liaison with print publishers.

.134 Because of the changing nature of different subject areas and print
practices one of the characteristics of a code should be expansiveness
or open-endedness, and explicit provisions for this should be made
at the outset.

.135 In code development and in the exposition of codes there is a question
of whether differences based on grade or developmental levels should be
considered

.1351 How could the difficulties caused by the beginning reader having to
learn different forms of the same word be resolved.

.1352 Could the introduction of code elements be controlled and possibly
based on frequency of occurence.

.1353 Should attention be given the fact that public school children often
have no one available to interpret the symbols, formats, rules, etc.

.136 Should there be two levels or grades of braille, one for the multi-
handicapped or retarded and one for the average visually handicapped,
viz, grade 1 1/2 and grade 2 for the respective groups.

.137 The task of developing a code is much too complex for part time
efforts; needed are the full time endeavors of personnel hired for
the purpose

.138 A number of problem items which have caused difficulty for the
computer in the translation of braille codes have been identified by
the Advisory Committee of the Braille Authority and Messrs. Robert
Haynes and John Seims of the American Printing House for the Blind.
These constitute general kinds of problems or factors to be avoided in
the development of a braille code

.14 Editing

.141 Editing is principally a format problem, and editors and transcribers
vary in their knowledge of the code and their practices of formating.

.142 Editing entails a decision of what should be reproduced. Who should
make this decision and on what basis. What kind of editing is useful
or desirable.

.1421 How would editing affect transcribers. They do not want or feel
qualified to decide what should be deleted or changed.

.1422 Should teachers edit the books before they are transcribed. Relatedly,
could procedures be worked out for transcribing both parts or sections
and the whole of a book.

1423  Would joint teacher-transcriber editing be feasible and resolve some
      of the problems inherent in the process.

.143  Should grade level considerations enter into this matter.  Should an
      attempt be made to determine what the regular class teacher of the
      lower grades, K-4, requires and expects of the blind child with regard
      to the use of the material in print books.  How much is meaningful
      and used by the resource or itinerant teacher.  Could information
      of this type provide the basis for editing lower level math books.

.15  Considerations Pertinent to Transcribing

.151  It is generally accepted that transcribers prefer not to have to
      decide the resolution of ambiguities and the determination of format.
      Inasmuch as the transcribers annually produce more titles than any
      other organization this consideration should be central to any future
      work on the codes.

.152  Under what conditions should transcribers list special symbols and
      symbols of other codes in the front of a book.

.1521  What should the transcribers do if they don't know the other codes.

.1522  Would it be desirable to determine the most commonly used special
       symbols by grade level.

.1523  On the assumption the reader knows the other codes could just a
       transcriber's note be used specifying the other codes which appear in
       the book.  Should different types or levels of books be treated
       differently.

.153  In reproducing tactual displays, principally maps, volunteer transcribers
      are forced to make decisions about a number of factors which, for the
      most part, they do not have sufficient information to resolve.  Answers
      to questions such as the following are needed by the transcribers.

.1531  Will the display be tactually readable or meaningful.

.1532  Could it be made meaningful and how.

.1533  How long would it take the reader to interpret and understand
       the graphic, and would the effort be justified.

.1534  Has the map already been produced and is it available elsewhere.

.154  Would using key punch machines instead of braillewriters make the
      transcriber's task easier and possibly encourage more persons to become
      transcribers

.16  Considerations Involving Computers.

.161  Computers are playing an increasingly important role in the production
      of literary braille and have a prospectively useful role in the
      production of music and math braille  Any future work on these codes
      or the development of new codes should focus on this contingency.

.162  The computer field is relatively new and rapidly changing.  Changes
      are also occurring in the technology and hardware of computers.  These
      factors should be kept in mind when the computer area is considered
      in connection with the Braille codes.

.163  Considering Braille in relation to the computer field there are two
      general areas of interest - (1) the development of a computer code
      and (2) the translation of print into Braille by means of the
      computer.

.164  In the braille community there are considerable questions about the use
      of computers in the translation of braille

1641  Regarding the computerization of braille it may be helpful to dis-
      tinguish between complication and conflict within a code.

16411 The former refers to different procedures, rules, or alternative ways
      of transcribing which are sometimes complex and difficult, but
      for which conditions of use are specifiable.  Involved are valuable
      techniques, nuances, etc , which should not necessarily be eliminated
      from the code because of complexity or difficulty

.16412 The latter refers to procedures, directives, or rules which do
      not adequately differentiate under certain conditions and in given
      situations are incompatible or controvertible   These items should
      be eliminated from the code.

.1642 The computer can handle any kind of logical, unambiguous rules or
      functions for which an algorithm can be written.  In practice, however,
      time and economics impose limits.

1643  Some of the rules of the current braille literary code are ambiguous
      and conflicting.  These require subjective judgment by the transcriber
      and are difficult for the computer to handle

.1644 The techniques involved in using the computer to translate print to
      braille have influenced the literary code and should and will in-
      fluence the development of codes in other areas.  These influences
      will be of the nature of greater consistency and standardization.

.17  Manuals and Guidebooks

.171  There is a need for a manual of format and techniques for each
      of the codes   Present manuals need to be examined for completeness
      of coverage, errors, ambiguities, etc

1711  The manuals should be cross referenced and specify priorities of rules
      and codes which take precedence.

1712  Would grade level or another type of ordered guidelines be desirable for
      the introduction of contractions and other difficult symbols.

.1713 Should separate rules or guidelines be developed for students and
      teachers

172   The present code books need more directions and greater specificity
      of rules and guidelines   Also needed are more varied and complex
      types of examples   This material could be placed in a supplement
      or addenda and cross referenced with the code book

.173  There is a need for a manual of guidelines for the production of tactual
      displays, and possibly there should be two sets of guidelines, one
      for volunteers and one for publishing houses.

.174  Should lesson books for the codes be developed for teachers.  Would
      it be desirable to present the codes on the basis of what is needed
      at certain levels.

.175  The American Printing House for the Blind has recently completed a
      1970 Addendum to the Code of Textbook Formats and Techniques.

.18  Considerations concerning the American Printing House for the Blind
     (APH)

     It is understood that many of the current policies and operations
     at APH have their origin in past federal legislation.  For this

reason some of the considerations below could not be implemented at this time. However, committee members felt that these suggestions would be beneficial to the field, and that they should be included in the report for future examination and action.

.181  There was general agreement that APH should assume a leadership role in the development and standardization of the braille codes, in effecting changes or innovations in the codes, and in assuring the future production of braille.

.1811  Efforts and attention should be directed toward the production of fewer copies of a greater variety of books.

.1812  APH should make efforts to broaden its base of production beyond the secondary school level and to produce more scientific and technical literature.

.1813  APH should have a volunteer group of transcribers connected with its operations and should take an active role in directing these groups.

.1814  Correlatively, the Braille authority or some other group or individual needs to monitor on a frequent or daily basis problems with the codes and changes in print literature and to take immediate action. Procedures for developing and maintaining current standards can be obtained from the American National Standards Institute.

.182  APH has embarked on a project to develop a computer assisted music translation program. The initial phase of the project runs from May 1971 to June 1972.

.183  Over the past two years APH has developed a braille Chemistry code which is compatible with the present Mathematics Code.

.19  The Development of an Overall Code of Braille.

.191  The rationale for an expanded-cell code.

.1911  Basic to all of the code problems and the computer translation of the codes is the multiplicity of meanings and the equivalence of symbols within and across codes. Many of the braille characters have more than one meaning, and, especially across codes, a number of characters have the same or similar meanings.

.19111  Related to this is the absence of compatibility of rules, procedures, etc. across codes.

.19112  Because of these conditions and the overlap of subject areas in texts the problem arises of when and how to use the different codes together. Furthermore use of the codes together requires knowledge of the various codes and causes difficulty in reading and hand transcribing.

.1912  To resolve these problems an overall code containing a large number of symbols is needed to embrace the different subject areas where separate codes now exist.

.1913  One way to obtain more discrete symbols is through an expanded cell construction.

.19131  In this regard nine-dot braille has recently received some attention; however, the number of available characters in this sytem is too limited to take care of the vast number of different print symbols.

.19132  A more workable system, and one recommended by the committee, is a variable column width construction which is similar to the Standard Dot System proposed by the Uniform Type Committee in 1915 and, with the exception of cell height, the old New York Point System.

.191321 With the variable width system there are more than enough discrete symbols to take care of the separate codes which now exist.

.191322 With the proposed system the symbology or notation of the present literary code could remain much as it is, only minor changes being required.

.191323 Where the most change in the present literary code would occur is in the spacing between characters and words. Overall, though, the number of characters per line would be approximately the same. The change in spacing would also require a change in the writing devices: for the braille writers and stereograph machines it would be only a minor modification, for the slates it would be a design similar to that formerly used for New York point.

.191324 Further, concerning devices and machines, if unambiguous and consistent codes or a code is available then the technology and equipment - writers, reading machines, etc. - will develop.

.1914 It is also possible that with technological developments something such as interchangeable ratchets on braillewriters would preclude the change in spacing and the literary code would be, for the most part, as it is.

.1915 To assure an objective consideration of the variable width system the computer committee would like to disseminate examples of the code and to hold a meeting of the other committees and individuals interested in the development of braille.

.192 Questions and alternatives to an expanded code.

.1921 The variable width system should be investigated and evaluated for (1) the legibility of the characters singly and in combination, (2) the readability of words, phrases, and sentences, (3) the amount of changes required in the existing system, and (4) its overall feasibility

.1922 Is an all embracing code desirable from the standpoint of the present Math and Music codes and the material available in these areas, the habits, attitudes, and type of the consumer, the possible greater amount of material to be learned, and the equipment and writing devices currently used.

.1923 Would the variable width code make the existing codes simpler or more complex in terms of symbol units, rules, etc.

.1924 How would the proposed code affect the number of symbols per line and the amount of material per page. How would tables, charts, etc. be affected.

.1925 How would the variable width code affect learning to read and reading behavior in the lower grades. What affect would it have in the later grades and on those adventitiously blinded.

.1926 Inasmuch as the principal source of conflict or problems stems from the relationship between the Math code and the emerging computer code could these differences be resolved and would this constitute an acceptable alternative to the variable width system.

.2 Specific to Areas

.21 Textbook Format

.211 Problems in the textbook area revolve primarily around format practices and rules.

.22 Mathematics and Science Code.

.221 At the elementary level teachers feel that the math code is too complex and that more time is spent working with the code than with the math concepts.

.2211 Some code elements may interfere with the concepts being taught, e.g. work with square figures often does not occur until the third grade but the symbol for the square is introduced in the first grade  How does this situation influence the child's concept of a square.

.2212 Could the code be simplified for elementary level students.  Would a graded teaching manual alleviate some of the difficulties with the code encountered by the young child.  Should math series be surveyed for introduction of symbols and concepts and the results used as a basis for the introduction of symbology.  Would changes in subject structure or curriculum affect the manuals.

.222 A recent revision of the math code has been made but it has left unattended a number of items which should be included in the code.  A review of the code is needed to determine what is missing and what should be included.

.223 Absence of official adoption of the Math Code has been considered partly responsible for the few number of volunteer transcribers in this area.

.224 Eventual certification of math transcribers presumably by the Library of Congress is anticipated.

.23 Music Code

.231 The exact duplication of inkprint copy results in the representation of some unnecessary symbology and material in braille, e.g. clef signs and parentheses  Could conventions be established for what should be included in braille.  Should a grade level or a beginning music level factor enter into what is represented in braille.

.232 In print music there are different ways of depicting the score; also there are anomalies peculiar to a composer or autographer, and sometimes the text contains errors.  What should be done with these things - should the anomalies and errors be changed; should standard guidelines be developed and specified for these variables.

.233 There are a number of different methods of presenting braille music, e.g. bar over bar, line over line, etc. whose use is determined by considerations based on the music.

.2331 Can the conditions under which these methods are used be specified and listed.

.2332 Should one method be preferred to another.  Could the best method be determined.

.23321 Should bar over bar be used in preference to line over line for simple and elementary music.

.23322 Should line over line be used more often.  Under what conditions.

.234 The reading of intervals for solo instruments in the trebel clef and orchestral scores varies - solo read downwards and orchestral read upwards

.2341 Which is the best method of reading.

.2342 With the exception of keyboard music why couldn't all intervals be
read upward

235—The braille representation of the more complex music requires stylistic
and interpretative decisions which will be difficult for the computer
to handle

.236 The computerization of braille music will lead to a more standardized
reproduction than was heretofore possible.

.24 Computer Area. Code Development

.241 The things which need to be considered in developing a computer code
are those which have already been reviewed and worked on by the
Braille Authority Advisory Committee, i.e the development of notation,
methods for handling special displays, and rules for use of symbols
and formats

.242 According to the committee there is nothing especially unique about
code development for the computer field except for special symbols and
some displays which are not much different from those encountered
in other fields

.243 In comparison with some of the other braille codes the computer code
has a restricted audience or limited interest and should be considered
as a subset of another code, most likely the Mathematics and Science
code. On the other hand, the computer code has broad applications
and its importance and use will increase considerably in the future.

.244 The big problems for the computer code and other codes as well, which have
already been mentioned above, are those of deciding when to use the
different codes and the multiple meanings and the variant uses of the
characters.

.245 What portion of text material should use the computer code notation
and what parts should use the literary and Math codes notation.

.2451 It is generally agreed that the listing of programs and displayed
coding sheets should be represented in the computer code. Are there
other distinctive items for which a certain code can be specified.

.2452 What should be done when a computer word or expression is embedded
in a different text. Can the conditions be specified under which
this situation can be handled. What should be done when computer
materials appear in lower level (high school) textbooks.

.2453 Should a rule be developed specifying that computer manuals are
nonliterary and therefore would use computer notation and punctuation.

.246 The different languages in the computer field present different problems
with respect to the development of a computer code. Provisions need
to be made for these different systems.

.25 Maps, Charts, and Diagrams Area

.251 Over the years there has been little change in the production of
maps by publishing houses; only within the past five years,
approximately, have new procedure been tried, but, in the main,
without a reliable evidential basis.

.252 Consideration should be given to having standard, commonly
occurring maps designed and produced by professionals, possibly
at a central agency

253 Inasmuch as most visual maps are generalized or distorted to delineate
important landmarks there is no good reason why tactual maps should
not be distorted to make them more tactually meaningful.

254 In the production of tactual maps consideration should be given to
making the maps useable by the partially sighted. In doing this,
practices appropriate to the two modalities need to be compatible.

| | TF | MU | M & C |
|---|---|---|---|
| 2.0 Problems of Symbols and Rules Involving Symbology | | | |
| .1 The use of much of the symbology of the different areas needs to be <u>reviewed</u>. Coincident with the review should be a specification of the <u>conditions under which</u> the <u>symbols</u> are <u>used</u>. Answers to many of the questions below should be sought in the review. | IIE,G | | |
| .11 Are the items which the symbols represent sufficiently defined to delimit or specify the invariant use of the symbols. | | | IIH2 |
| .12 When should the symbols be used. | | IIA1,B1, IIIL3 | |
| .13 How is their use influenced by different types of material. | E,F | | |
| .14 How frequently are the symbols used. | C,F1 | | |
| .15 If used infrequently should they be eliminated. | C,F1,G1 | | |
| .16 Is what the signs represent meaningful or significant in terms of distinctive information imparted. | | IIF1 | |
| .17 If the information is not distinctive or is unnecessary could the symbols be eliminated. | | F1 | |
| .18 If eliminated should other meanings be assigned to the characters. | F2 | | |
| .19 Under what conditions should the symbols be used in various language forms, e.g. prefixes and suffixes. | E1,2 | B3,I | |
| .20 Could the use of the symbols be the same in all words and content within a given area. | E,E3,F | | |
| .21 Under what conditions should special or clarifying symbols accompany other codes. | | IIF2,H4 | D,E |
| .22 What effects will revisions or changes in the symbology and rules have on other parts of the code and on other codes. | | | A2,D |
| .23 Should the readability of certain symbols singly and together be determined. | | C1,D1, H1,2 | |
| .24 Should a standard list of special symbols and forms be prepared, e.g. abbreviated words and measurements. | G2 | | |
| .25 Are the rules for use clear, unambiguous and complete | E | A1a,H1, H2,H4 | |

|  | TF | MU | M & C |
|---|---|---|---|

.26 Should certain operations or transpositions implied by the symbols or content be made for the reader by the transcriber.  —  F3

.27 What are the effects of grade level on the use of symbols, or, in other words, what considerations should be made about grade level and the use of symbols.  G3  J

.3 What should be done about different symbols representing the same things within and across codes.

.31 Should the characters or signs be the same.  A  —  A1

.32 Under what conditions and for which code elements.  B  —  C

.33 Do and should symbols within a code always mean the same things.  E3  —  B,H

.34 What should be done about variable print practices of using the same symbol in different ways.  —  —  G1,2,H, 1

.35 Is the meaning of the different print representations the same.  —  —  G1

.4 What should be done about the placement, arrangement, or alignment of symbols together and with other materials.  —  —  IIF Com IIIB5

.41 What are the most readable ways of using certain symbols together.  —  IIB4,C1, E,G2,H2 III 1  Com IIIB3

.42 How do they best represent the print expression.  —  G1,H3

.43 How does their disposition best preserve the character of the material.  —  IIA1b  IIF Com IIIB4

.44 What should be done when the material in question is carried over from one line to another or one page to another.  —  B2,D2, H1

.45 What should be done about "floating dots," the condition in which the relationship among dots in two or more cells makes the level of some of the dots difficult to determine or in other ways causes loss of alignment or orientation to the characters. These configurations are especially difficult for the young child. Could a special indicator or re-reference sign be developed.  —  D,B  B5,K4

.46 Are there grade level considerations which should be made regarding these questions.  D  —

.5 Symbology or notation is needed to represent new, special, or currently undepicted print symbols in some of the existing codes.  H,I  K2,3,5  II 11,2, 3, Com IIIB1

|  | TF | MU | M & C |
|---|---|---|---|
| 51 Are the print sumbols sufficiently invariant and widely recognized and agreed upon. |  |  | II IIa |
| .52 Should braille or some other signs be used to represent the print symbols. |  |  | II Ilb<br>Com<br>IIIB4 |
| .53 In the music area a representation is needed showing when two fingers or two hands are to perform some action. |  | IIIH,<br>IIIKl |  |

3.0 Formats and Linear Displays

.1 Formats

.11 Formats for the different parts of a book

.111 The cover and volume identifcation.

| | TF |
|---|---|
| .1111 Where on the cover is the best place to identify or title a braille volume. Where would the title be most readable and accessible. | IIIAla,b |
| .1112 In which direction should the title run – horizontally or vertically. | 1c |
| .1113 What information should be included along with the title. Could the Arabic numerals be substituted for the Roman for the volume number on the binding. | ld |
| .1114 Should there be different ways of titling different types of books or books produced by press and those produced by braillewriter. Guidelines are needed for both braille and print title pages. | le |

.112 Title pages.

| | TF |
|---|---|
| .1121 What is the best format for the title pages. Where should the material be placed on the page. Should it all be left - justified. | A2a |
| .1122 Should different items of information be included for different types of material, e.g. the initial letters of words contained in a volume of a dictionary | 2b |

.113 Indices

| | TF |
|---|---|
| .1131 Are indices in their most readable form. | A4a |
| .1132 Should the index terms be fully capitalized or italicized when they appear as such in print. | 4b |

.1133 How should they be paginated (see pagination
3.121) What should be done when a volume
starts in the middle of a page.     4c

.1134 What should be done with subheadings in indices.
Should they be indented and how. (See Runovers
3.135)     4d

.1135 Should a standard terminology be developed for
the characteristics of braille and the rules of
format, etc. to be used in the indices of manuals
and texts dealing with braille. Should that
which is used in the official code book be the
standard.     4e

.114 Appendices

.1141 Where should appendices and materials, which is
referred to and needed in the text but which is
ordinarily found in the back of the print book,
be placed in the braille book - within the volume
where the reference is made, at the back of the
braille volume, in the last braille volume, or
in a supplement     A5

.11411 Should its location be contingent upon the sig-
nificance of the material.     5a

.11412 Could such material be classified according to
different types. Should size or amount of ma-
terial determine placement     5b

.11413 What should be done if the material is referred
to repeatedly througout the text.     5c

.11414 Could guidelines be developed to indicate
how such material should be handled.     5d

.115 Glossaries

.1151 Should there be more braille explanatory material
in the glossary sections of books.     A6

.12 Formats for page variations

.121 Pagination

.1211 What is the best manner of numbering pages.
Where and how should the braille and ink page
numbers be indicated     IIIB2   IIID1

.12111 Should page numbering be the same for
different types of materials within and
across areas.     IVB6    D2
biv

.12112 Where on the page would the numbers be
most accessible.     IIIB2a

|  | | TF | MU | M & C |
|---|---|---|---|---|

.12113 Should the ink print page number appear at the top or the bottom of the page with the braille number opposite or adjacent thereto. Should the numbers be on the right hand side of each page. — **TF: 2b**

.12114 How should the numbers be indicated when the ink page stops somewhere within the braille page. — **TF: IIIB2c**

.12115 How should the pages be numbered when an article, e g. biography, is inserted between the pages of a text. Could the phrase, "continued on page so and so," be used. — **TF: 2d**

.122 Numbered and lettered lines including those which are to be counted or otherwise reckoned and measure numbering.

.1221 Where and how should the numbers be placed, indented, and spaced. Spacing needs to be different for different sized numerals and allowance made for runover indicators — **TF: IIIB3a** **MU: IIIEla** **M & C: IIIB4**

.1222 How should measures, parallels, and braces be numbered for solo stringed instruments, un-barred music, and choral music. — **MU: IIIE2, 3,4**

.1223 Do some of the designator's need to be accompanied by a transcriber's note. — **MU: IIIE3**

.1224 In the Bible the print numbering practice varies, should a standard practice be developed for Braille. — **TF: IIIB3b**

.1225 Under what conditions should number and letter signs be used. — **TF: 3c** **M & C: Maps IVB**

.1226 Rules and procedural guidelines for the above need to be clarified and expanded in the code manuals. — **MU: IIIElb,2**

.123 Page Titling and key and time signatures.

.1231 Where and how on the page should the title of a book and the key and time signature of a score appear - at the top of every page, full spelling or abbreviated, with or without cap. signs. — **TF: IIIBla, b,c** **MU: IIIFl**

.1232 How should a change of signatures within a page be indicated — **MU: F2**

.1233 For the young child could something be devised to indicate which keys are to be played. — **MU: F4**

|  | TF | MU | M & C |
|---|---|---|---|

124 Alignment and juxtaposition of materials (Related to Runovers and Margins).

1241 When two or more lines are related or, in some way, correspond and unequal designators, expressions, or directions appear at the beginning of the line how should subsequent material be aligned. — IIIA1 — IIIB4

1242 Should vertical alignment be different for different types of material and different operations. A1a,B1, B1c

1243 When two lines are to be read together and one line is regularly longer than the other should there be a certain way of always ordering or juxtaposing the lines. Should there be exceptions at the elementary level. IIIB1a,b, B4

1244 When lines of material are to be read together or associated could they be placed on facing pages B5

1245 In the development of mathematical principles could the statement and reason be alternately presented How should they be designated, divided when runover, and indented. IIIE2b

1246 Could the statement and reason of mathematical principles be set up side by side Should different types of these materials be set up differently 2c

1247 How does the extra space between lines at the elementary level and the use of tracker dots where there are seven or more spaces between symbols affect the reader's ability to vertically and horizontally align the characters. J,K

1248 The rules governing the practices of alignment in the code manuals need to be clarified and expanded and more examples given A1b,2

125 Runovers, Word and Measure division and Hyphenation (Related to Alignment and Margins.)

1251 Should certain types of material be treated differently regarding division and continuation from one line or page to the next. IIIC4d B3,4 A1,3

1252 Should different functional modes determine where materials are broken and the disposition of the parts, e.g. in music the length of in accord measures, and in math linked and non-linked modes. C1,a,b A2a,b

1253 Could a priority break list be developed In the code manuals rules governing runovers are inadequate, and, in general, more rules and examples are needed to cover a greater range of situations. B3b,c,2, A4
3

| | TF | MU | M & C |
|---|---|---|---|

1254 How should the break be indicated. Does it always need to be indicated  Could the present practice of hyphenating words be eliminated.  → C | B3a | A4,b

1255 Where should the continuation sign be placed in relation to the break - after, before the re-. sumption of the material, or in both places → IIIA4c,d

1256 Does use of the hyphen save much space. Does its use affect readability. The hyphen is not used in the literary braille computer translation program → IIIC4a, b,c | | 4b

1257 When a division is made at a sign of operation, where should the sign of operation appear. - at the end of the line, at the beginning of the next line, or at both places. → 4a

1258 Should division of materials and indicators thereof be handled differently for children in the lower grades. → 4e

126 Margins (Related to Runovers)

1261 Often more symbols per line or a line wider spaced than what is currently used is needed. Could the publishing houses produce a 40 or 41 cell line since the current standard of 38 is primarily a convention. → Com IIIB6

1262 Should different types of material be treated differently with respect to margins. Could different materials be classified and specifi- cations developed for the different classes. → IIIB1

1263 Is the proposition factual that most braille. readers prefer all material flush with the left most margin because it is more accessible and diminishes search time. → III

1264 Where on the following line should runovers begin. Should they be indented. → B2

1265 Should different types of runovers be marginated differently. What could be done with successive runovers. → B3

127 Footnotes, references, marginal information, and glosses.

1271 Could notes be classified as to their kind and function and should they be treated accordingly. Particular attention should be given to the notes of plays. → IIIA3a

1272 Should their length and number enter into how they are classified. → 3b

|  | TF | MU | M & C |
|---|---|---|---|

1273 Where should the notes and glosses be placed –
next to word, at end of line, at end of sen-
tence, at end of paragraph, at bottom of page,
at end of chapter or section, in back of volume,
in back of book, in separate volume. Should
they be indented. Should they be separated
from the other material by lines of dots. **3d IIIG2,a,b,c**

.1274 Could their classification determine where
they are placed **3e**

.1275 How can they be referenced or indicated. **3f G1**

.12751 How can the reader determine which note goes
with which indicator - by numbering, by
repeating word. **fi**

.12752 Under what conditions should the two
procedures be used. **fii**

.21753 Should there be different indicators for the
different types of notes. **fiii**

.1276 When referencing material should the Arabic num-
bers be substituted for Roman numerals as the
code recommends? **3g**

.1277 What should be the order of presentation of
footnotes and glosses when both are copious. **3h**

.12771 What are the conditions on which the orders
are based **hi**

.12772 Where and how should the pages be numbered when
the notes or glosses are continued over
several pages. **hii**

1278 Where and how should the author's initials or
other references be placed and indicated when
they are found below and to the right of a
passage or verse and sometimes preceded by a
hyphen or dash. **3i**

.1279 Are the rules governing the use of footnotes
for foreign language (section 5, T.F.) adequate
for all prose material. Clarification of the
indication of footnotes is also needed in the
manuals **3c G1**

.128  Transcriber's Notes

.1281 When transcriber notes and keys are used with
displays what should be done about the following:
placement, division, indentation, spacing,
designation, vocabulary level and differentiation
of author's and transcriber's notes. **IIID1**

.1282 Should there be special symbols indicating a
transcribers note **IIID2**

.1283 Where should the indicators and notes be placed
relative to the material referenced. **D3**

| | TF | MU | M & C |
|---|---|---|---|
| 1284 For the mathematics code a transcriber's grouping symbol dots 6 and 3, has been developed which is placed before and after the note. Is this the best form of indicator that can be devised | | | D4 |
| 1285 In composing notes the grade or developmental level of the vocabulary should be appropriate. Could standardized messages for frequently occurring conditions be developed. | | | D5 |
| 1286 How should transcribers notes be spaced relative to margins and material above and below. Should different types of materials be spaced differently, e g. literary vs. exercise material | | | D6 |

129  Variant Type Forms and Print Devices for Emphasis

| | TF | MU | M & C |
|---|---|---|---|
| 1291 Different type forms, italics, capitalizations, etc. often are means of emphasizing or distinguishing material in texts; in other cases they are merely commercial artifices. Could a determination be made of the significance of these variant forms. Could the variant forms be classified and treated accordingly. | IIIE1, a | | IIIC1 Com IIIA2a, c |
| 12911 In resolving these problems a central consideration should be the differences between working on plastic. paper, and metal. | E1b | | |
| 12912 What considerations should be made about this matter with regard to transcribers. They usually delete as much as possible of these contrivances.. Should there be conventions for this. | E1c | | |
| 1292 Especially in the Mathematics and Computer areas provisions are needed for different print type fonts and different sized type. | | | IIIC2, Com IIIA2b |
| 12921 Could symbols be devised for these items. Should the symbols be standard across areas. | | | IIIC2a,c |
| 12922 Where should these symbols be placed in reference to the material being modified. | | | C2b |
| 12923 When a special braille symbol is used for a special print symbol, should the print symbol be depicted somewhere so the braille reader will know how it appears | | | c2d |

.1293    What should be done with italics and the italic        ----
         sign   The Braille Authority has been asked to
         eliminate this sign.                                   IIIE2

.12931   Its use requires a subjective judgment of what
         should be emphasized or distinguished.                2a
.12932   There is also the matter of when it should be
         introduced in Braille.                                2b
.12933   What effect does its use have on the readability
         of braille                                            2c
.12934   Could more meaningful objective conditions for
         its use be established.                               2d
.12935   In the expression of development of special
         laws, principles, or mathematical formulas
         made up of different parts should one of the
         parts be in bold face or italicized type or
         should some other special indicator be used to
         delineate and distinguish between them.                                              IIIE2a
.12936   What should be done when a bold face or other
         type is embedded in another special type such as
         italic.  Provisions are needed for this situation.                                   IIIE3

.1294    Double caps - In ink print there are three types
         of caps - should these be represented in braille.     IIIE3

.12941   When should they be used or not used.  Should
         some other procedure be used for directing
         attention to the material.                            3a
.12942   When a considerable amount of fully capitalized
         material appears within the text should some
         symbol other than the double caps before each
         word be used.  Could the italics principle be
         used.                                                 3b
.12943   How much space should be saved for varying
         amounts of material using double caps as
         opposed to a symbol preceding the
         capitalized material.                                 3c

.1295    Underscoring.  What is the best method -
         dots or smooth line                                   IIIE4

.12951   Should spacing between underline and material
         be considered.  What is the optimum spacing
         between the line and the material above and
         below.                                                4a
.12952   Is there a grade level factor involved which
         is related to spacing.                                4b
.12953   Should italics be used instead of underline.
         Under what conditions should the italics
         sign be used.  When should the switch be
         made.                                                 4c

|  | | TF | MU | M & C |
|---|---|---|---|---|

.1296  Paragraph headings - material on headings needs
       review and clarification.                                  IIIE5

.12961  Have too many distinctions and provision been
        made for the different forms of headings, sub-
        headings, etc   Could this matter be simplified.     5a
.12962  Should a line be skipped before a heading to
        emphasize change in topic.                            5b
.12963  Could the differentiae for the various types of
        headings be specified.  Should the treatment of
        these types be standardized or only kept con-
        sistent within a text.                                5c

.1297  Colored type - its use is on the increase con-
       siderably                                                  IIIE6

.12971  What should be done with colored print - should
        it be coded; or boxed or underlined, etc.            6a
.12972  Should a judgment be made about whether the
        material is meaningful or referenced in the
        text or whether it is merely for eye appeal,
        and then treated accordingly.                        6b
.19273  What should be done with colored sections of
        books.                                               6c
.12974  What should be done when different shadings of
        colors are used for different purposes.              6d
.12975  Should different constructions be developed
        for different situations - could these situations
        be listed.                                           6e

.1298  Miscellaneous designata - arrows, overlines,
       numbers

.12981  Where and how should arrows be placed that
        point to words or different parts of words.
        Could different situations be determined for
        which different conditions or practices
        could be devised                                     IIIE7,a,
                                                             b

.12982  How should line segment designations be
        treated.  Could a row of dots 3 and 6 placed above
        the material be used to designate the segment.                         IIIE4
.12983  For figured bass and chord analysis in music
        and other materials where numbers appear under
        a symbol what is the best way of presenting.
        Rules and symbols are needed for this material,              IIIl2a,b
.129831  Is interval interpretation easier when
         represented by numbers.                                      2c
.129832  For reading intervals the current code symbols
         are in contradiction with print and with the
         logical ordering in harmonic constructions.
         Could better alternatives be developed.                      2d

.13   Formats for Language and Special Materials

131   systems of pronunciation, pronunciation marks,
      and puncutation.                                    IIIC

1311   In the 1970 addendum to the Braille Format and
       Techniques manual diacritical notations has
       been worked out for five new dictionaries -
       Webster, New World 1970, American Heritage,
       Random House. Funk & Wagnal, and Scott-
       Foresman.   Should these systems be evaluated.     IIIC1

1312   What is the purpose of having three types of
       stress signs.   Are they all needed.              C2
.13121   How do these signs affect the readability
         of words.                                        2a
.13122   Is there a grade level factor involved in
         their introduction and use.                      2b
.13123   The conditions for using these signs needs
         to be clarified and specified more rigidly.      2c
.1313   What should be done with diacritic markings
        appearing in spelling books which are
        different from those provided in the code.
        Mark according to and referencing new code
        revisions.                                        C3
.13131   Should special signs be provided and noted.      3a
.13132   Should ones from the code be used.               3b
13133,   Should special symbols be delineated in a
         standard way.                                    3c
.13134   Occasionally phonetic and diacritic signs
         are used together which means that the same
         signs having different meanings are being used
         in the same word.                                3d
.131341   The braille phonetic code conflicts with
          braille accented letter signs of foreign
          languages - could this situation be
          remedied.                                       3gi
.131342   Would the use of a special indicator
          resolve this problem                            3di
.131343   Could warning statements or notes be used
          to differentiate or specify the different
          systems that are used and how they are
          used.                                           3dii

.132   Plays

.1321   A standard method of representing should be
        devised.   Should the standard method be
        related to the type of play.                      IIID1a

122

.1322  What would be the best way of differentiating
       actors parts, stage directions, and stage settings.     1b
13221  How should the different actors parts be repre-
       sented.  How should it be indicated that a
       second speaker is to complete a line.                    bi
.13222 How should stage directions and settings be re-
       presented   Where and how should they be placed.
       How should they be designated.                          bii
.13223 Where should notes be placed relative to their
       reference   How should this situation be treated
       where the notes are copious.  (See III A 2)             biii

.133  Poetry

1331   What is the best way of presenting poetry.  Should
       a standard method be devised.                           D2a
.13311 What should be done with poems having unusual for-
       mats, e g  shaped like a tree, or the work of E.E.
       Cummings                                                 ai
13312  If the print format is not followed how could the
       appearance or structure of the poem be indicated
       to the reader.  Is it necessary to show this.           aii
.13313 Should a transcriber s note be used describing the
       structure of the poem.                                  aiii

134  Foreign Languages.

.1341  All languages for which braille notation is avail-
       able need study of their symbology and its use.
       Review should be made of M. Loomis' Standard
       English Braille in 20 Lessons, 1947, for her
       treatment of accent and diaeresis signs in foreign
       languages.                                               D3a
.1342  Transcribers should be consulted about foreign
       languages because there are differences among them
       in the way they treat ambiguous or problem
       situations.                                             3b
.1343  In print language texts much of the material is
       presented spatially - how should it be done in
       braille.  Some guidelines for certain braille re-
       presentations can be found in the grammar section
       of the Textbook Code and need to be cross-refer-
       enced.                                                  3c
.1344  Should notation and rules be developed for languages
       for which provisions are not presently available,
       e g. Portugese                                          3d
.1345  In developing material for foreign languages it
       should be kept in mind that the transcriber
       doesn't necessarily know the language with which
       he is working.                                          3e

|  | TF | MU | M & C |
|---|---|---|---|

.1346 It is the attitude of many,that English-braille
and foreign language braille should be kept
separate, i.e., special provisions for each.          3f
.13461 In changing or shifting from English to a
foreign language, e.g. in a grammar book,
there is nothing to indicate the change,
which situation is confusing to the reader.          fi
.13462 Should some symbol be used for this purpose.
Could the italics sign be used to show the
change of language  If so, what should be
done with material that is already in italics.          fii
.13463 More provisions on the use of italics in these
situations are needed in the TF manual.          fiii
.1347 For the transcription of foreign words, braille
grade 1 is used while the other characters re-
present accent and sounds.          3g.
.13471 How should inflections within and between words
be represented in foreign language transcription.
For rules on inflection between words the foreign
language section of the TF manual needs to be
cross referenced with the speech instruction
section.          3gii
.13472 Should the slash, which ordinarily has no space
on either side, be accompanied by spaces if it
appears so in print.  In Spanish and Italian the sign
for the slash also represents the vowel sound i
acute.  Could the dash be used instead of the
slash symbol.          giii
.13473 In foreign languages italicized vowels mean that
the vowel is stressed, however the s also is
frequently italicized which indicates it
carries the "z" sound.  How should these items
be represented in braille where there is a
special sign for stress and a sign for italics.          giv
.13474 In Italian acute symbols for the vowels are
needed.          gv
.13475 When the text or main part is in one language and
a footnote or reference is in another should the
accent signs differ for the same word in the
different languages.          gvi
.1348 The diaresis in French Textbook Format allegedly
is confused frequently with the macron.  What
could be done to eliminate this confusion.          3h
.1349 When most of the words of a sentence are in
English what should be done when to, into, or by
comes before a foreign word.  Should these
prepositions be contracted or written out and
should they be placed adjacent to the foreign
word.          3i

.1350    In German only the first letter of nouns is
capitalized and the double cap sign is not used -
capitalization serves as an earmark. When follow-
ing the rules for titles and using double caps,
what should be done to distinguish word capi-
talized within the title.                  3j

.1351    In the TF manual could the words "in the entry"
be inserted after "used" in the first line and the
colon and definition be added to the examples to
clarify that item.                            3k

.1352    On the title page of foreign language books the
title uses the special symbols of the language,
but the rest of the information - author, pub-
lisher, etc. - is in English. Is this a desirable
practice - how should the title page items
appear.                                         3l

.1353    In Spanish the opening and closing conversation
signs are confusing. In print it is a dash.
The braille sign misleads the student and violates
the braille rules when used adjacent to a period.
What should this sign be? Could it be a dash
the same as in print. A rule is needed specify-
ing that the Spanish custom of not using a closing
conversation sign should be observed by transcribers.    3m

.1354    In foreign language should the division of words
and hyphenation be treated differently from the
practice of English braille. To what extent
should the foreign language rormat be followed
compared with that of English braille.               3n

.2   Linear Displays

.21 General

.211    The problems with displays in all areas are similar
and are reducible to the more basic matter of making
two and three dimensional print figures tactually
meaningful. Even so, within certain areas some
figures occur with greater and lesser frequency.
Should these figures be classified and separate pro-
visions made for each of the areas.                    Com
                                                          IIIC1

.212    This whole area needs considerable study which
should result in the development of principles
governing the representation of displays. A use-
ful starting point may be a survey of transcribers
to determine what principles they use, principles
which may be intuitive or have been passed along
as folklore. These guides used by transcribers
should be defined and investigated.                    IVA2
                                                           Maps

|  | TF | MU | M & C |
|---|---|---|---|

213 Many types of print displays either cannot be re-
produced in an embossed form or are represented
in some other than the original form. — IVB1 — Com IIIC1a

2131 Could more readable and more isomorphic
representations be developed for these
displays. — — — Com IIIC1a,c

2132 Is knowledge of the visual, spatial arrangement
necessary for the reader to achieve understand-
ing and comprehension of the concepts involved. — — — IVB4

2133 Should the form of presentation depend on the
type of material represented. — — — IVD2

2134 What considerations should be made regarding
transcribers and displays they are unable to
reproduce. — IVB1

214 What considerations should be made regarding
the representation of displays from the
standpoint of education and grade level of
the reader — B4 — IVB3,D8

2141 What concepts are involved and should be
taught to children to enable them to read
displays — A2e

2142 Should an investigation be made of the
social-emotional factors related to having
materials similar to sighted peers — B5

215 Efforts made in this area should consider the
changing nature of displays, new publishing
techniques which are replacing the traditional
standard forms, and those changes coincident
with the use of computers in processing forms. — A1b, C1a

216 Should an instructional manual containing
standardized guidelines be developed for
displays. — C4 — A9

2161 Should the guidelines vary for the different
types of production, one-sided vs. two-
sided or single vs. multi-copy. — — A4

2162 How complete should the guidelines be in
covering the various instances of different
types of displays. — D3 — F3,6,G6c

217 Could a standardized set of tools be developed
for the construction of displays and symbols
within the displays. Could the tools be the
same for the different types of production. — IIIC3 — IVA4,8

.22 Types of displays and their placement.

.221 There are many types of displays needing
considerable research and development. Among
them are those specified alphabetically

|  | TF | MU | M & C |
|---|---|---|---|
| below. This listing is not exhaustive; merely ones mentioned by the committees for which particular problems existed. Algorithms, Business forms, Commercie schedules, Determinants and Matrices, Diagrams, Exercises, Family trees, Flow charts, Graphs, Math expressions in general, Outlines, Punch cards,Tables, Test materials, Time lines, Tree diagrams. | IVA1,3, C1,3 |  | IIIE1, IVF,2 |
| .222 Could different kinds of these displays be classified possibly on the basis of different variables, and their classification determine how they are treated. | A2aii, iii,3a, i,ii, C1b |  | IVB1,2, F1 |
| .223 What is the most readable form or arrangement for presenting these displays and different kinds of these displays. | A2a,D1, E,F |  | C1,D1,E1 Com IIIC1b |
| .2231 Where should the displays be placed on the page. Is there an optimum position on the page where the displays should be located. | D1 |  | IVD3 |
| .2232 Where should the displays be placed in relation to other material on the page. |  |  | F8 |
| .2233 How should data accompanying displays be arranged with respect to the display. |  |  | F4,a,b, H3 |
| .2234 What should be done when the display is too large to fit on a single page or the display runs across a number of pages. | IVA1ai, 2b,C2 |  |  |
| .224 In the production of these displays should a standard method be developed. Is a standard method possible for the different types of media (paper and plastic) and the different production processes (braillewriter, thermoform, and press). |  |  | Com IIIC2 |
| .23 Modification and alteration of displays. |  |  |  |
| .231 In some displays certain operations or relationships between elements are essential to the information conveyed, and are difficult or misleading to represent in braille. How can these displays be represented. | F,1,2 |  | IVC1a,b,H Com IIIC1c,d |

|  | TF | MU | M & C |
|---|---|---|---|

.232   What should be done with displays which are
      difficult or impossible to represent in
      their original format.        E            IVD7,G4,
                                                         G5bi,ii,6,
                                                         6a

.2321   How should they be arranged on the page.      A2ai
.2322   Under what conditions should certain
       elements of some displays be transposed.                    F
.2323   Should the size or length of the material
       determine the arrangement.                           G6b
.2324   Could standard methods be devised for
       different types of these displays.       E1                 G4
.233   What should be done for certain displays
       in which the instructions are separated from
       the examples and exercises                            G1a,3b
.234   What should be done with displays, such as
       pictures, which cannot be represented
       tactually.                             IVB3
.2341   If the pictures involve certain functions
       or activities related to the text should
       they be described. Could their educational
       or informational value be maintained
       in a description. Could common functions be
       classified and guidelines developed for
       their disposition.           B3a,b,c,
                                          e

.2342   Should simple embossed pictures or symbols
       be developed to represent frequently
       occurring objects or shapes.       B2
.2343   If the picture cannot be represented what
       should be done with the caption.       B6,a,b,i

.24   Titles, Headings.

.241   Should the title of the material be placed
      on every page, and where should it appear.     B6bii
.242   Where should the title of a table be placed
      with respect to the table - above, below,
      in both places, at the bottom of the page,
      centered or left-justified.                           IVF7a
.243   Should the treatment of the titles depend on
      their length.              A2c
.244   Where and how should columnar heading be
      indicated. In large tables where columns
      are repeated do the headings need to be
      repeated.              A2c               F5c

.25   Designators, Indicators.

.251   Where and how should displays be numbered
      or otherwise designated.                     IVF7

|  | TF | MU | M & C |
|---|---|---|---|
| .252 What is the most readable manner of numbering or designating different types of material such as columnar material, test material, exercises, and answers. | IVA3b,i | | G5,b,6 |
| .2521 Under what conditions should different types of material be labeled horizontally and vertically. | | | G5bi,6a |
| .2522 Where should the indicators be in relation to the left-most and functional margins. | | | G5a |
| .253 Within some displays certain relationships or reference points are importnat to information depicted. How can these points be indicated. | E2,3 | | |
| .254 For displays divided and runover or extended how should the division be indicated. | F5b | | C3c,D6b |
| .255 In the math area is the transcriber's enlarged grouping symbol sufficient for delineating explanatory, subordinate, accompanying material. | | | C4c |
| .256 What is the most readable manner of presenting arrows, lead lines, tracker or tracer lines vertical and horizontal cancellation, cancellation of whole rows and whole columns, horizontal, vertical and diagonal ellipsis, etc. | | | B3,b,D5, E2c,d,i,ii, e,F11 |
| .2561 How much of this material is meaningful to the braille reader. | | | B3a |
| .2562 Where should this material be located with respect to what it is modifying. | | | B3c |
| .257 When researching this material consideration should be given to the question of similarity of designations for public school blind children and the sighted child and teacher. | | | A3bii |

.26 Spacing

| .261 In spacing between groups and before a topical heading in outlines, between instructions and exercises, table number and title, and above and below a math expression or formula, should a line be skipped before, after, or both. | IVA1aii | | IVB3d,C6, F7b, G1a |
| .262 In tables what is the optimum spacing between columns and between headings and rows. | | | F10 |
| .263 How should the material be spaced relative to process words in equations, viz therefore, thus, since, and, but, etc. | | | B3e |

264   Should spacing vary depending on the grade or
      developmental level of the reader.                          B3f,F10

.27   Alignment                                                   _____|

.271  How should the steps and operations of algorithms
      and successive terms of equations be aligned.               C2,D4
.2711 Should different kinds of these materials be
      treated differently.                                        C2a
.2712 What should be done when parts or terms within
      the material are larger than other terms with
      which they are aligned and/or compared.                     D4
.2713 Should mathematical material be aligned on the
      equals sign or could some other form be devel-
      oped.  Does alignment on the equals sign have
      any mathematical significance.                              C2,b,i
.27131  What should be done where expansion represents steps
        of an operation, e.g. the evaluation of exponents.        C2bii
.27132  What should be done when the left hand terms
        of an equation remain the same.                           C2biii
27133   Where should the equals sign or any sign of
        comparison appear with respect to links ending
        or beginning a line.                                      C3d
272   Some displays require the comparison of values
      or elements with other referents.  How can these
      elements be aligned for optimum comparison.                 H1,2

.28   Margins, Indentation.

.281  For outlies, tabular, and test materials is the
      present form of successively indenting each sub-
      unit two spaces and bringing runovers to the
      margin the most readable.                     IVAla
.282  In the case of a number of exercises, each with
      its own instructions should one or the other be
      indented.                                                   G1,b
.283  Should long paragraphs within exercises be
      indented beyond the functional margin.  In what
      cell should they begin                                      G2a
.284  For numbered or lettered material how far should
      the functional margin be from the designators.              G5a

.29   Runovers, Division of Material.

.291  Where and how should large tables, arrays,
      problems, exercises, and test materials be
      divided or segmented within and across pages.  IVA2bi,              IVD6,E3,
                                                     3c                   a,F3,F5,
                                                                         a

|  | TF | MU | M & C |
|---|---|---|---|
| .2911 Should different kinds of these materials be treated differently. |  |  | D6a |
| .2912 For test materials should questions and answers be separated across pages. | A3ci |  |  |
| .2913 What should be done with exercises which are word problems. |  |  | G3a |
| .292 What should be done with runovers in these materials and in long titles, exercises, and long paragraphs within exercises. |  |  | F7c,G1c, G2b |
| .293 How should runovers of table entries be treated. Spacing would be a factor in this situation. |  |  | F13 |
| .294 Presently, there are two ways of treating runovers of entries in determinants and matrices - (1) left justified with line skipped below and (2) indented with no space below. Is only one method needed. If so, which is the best; if not, could conditions of use be specified for each method. |  |  | E2b |
| .295 How should runovers in formulas and equations be treated. |  |  | C3 |
| .2951 Where and how should a division in equations be made. |  |  | C3a |
| .2952 Should the number and size of links influence how they are divided. |  |  | C3b |
| .2953 Should the extent of formulas or equations affect how they are handled. |  |  | C1c |
| .300 References, Footnotes |  |  |  |
| .3001 How should the following types of materials be referenced: explanatory, subordinate, accompanying materials; footnotes within tables, and formulas. | IVA2d |  | C4b,C5 F14 |
| .3002 Should there be a standard form for referencing these materials regardless of the print format. |  |  | C5 |
| .310 Enclosures, Explanatory Material, Entries. |  |  |  |
| .3101 What should be done with such things as boxed and circled material; reduced-type, multi-lined, subordinate or explanatory materials or formulas, and embedded or isolated materials and formulas. | IVC2a |  | IVB3 C1d,C4 |
| .31011 Where should this material be placed in relation to that which it accompanys or modifys. |  |  | C4a,f |
| .31012 Should different kinds of these materials be treated differently. |  |  | C4d |

|  | TF | MU | M & C |
|---|---|---|---|
| .31013 Should boxed or circled material be enclosed. |  |  | C43 |
| .310131 Could some of the enclosing or grouping symbols be drawn in rather than using the braille configurations. |  |  | E3c |
| .310132 What would be the best symbols for drawing. |  |  | E3c |
| .3102 How should entries and other signs of operation within different kinds of arrays be treated. |  |  | E2,e |
| .31021 Is the present form of left-justifying all entries the most readable and does it adequately cover all conditions. |  |  | E2a |
| .31022 Could the enclosed material be keyed for the information it contains. |  |  | C4e |
| .3103 Should the practice of using single and double print lines to separate and distinguish parts or sections of tables be followed when using braille lines  Do the lines have a meaningful function besides that of esthetic appeal.  Is their meaning the same in the tactual mode. |  |  | IVF9 |

.320   Techniques and Miscellaneous.

|  | TF | MU | M & C |
|---|---|---|---|
| .3201 For different types of materials and displays could facing pages be used: | IVA2bii, A3cii, C2d,D1a |  | A5,B3h F5d |
| .32011 Could conditions be determined under which facing pages should or could be used advantageously. |  |  | A5b |
| .32012 Could new, more efficient techniques be developed for setting-up and using facing pages. |  |  | A5a |
| .3202 Could different representation techniques such as the "skeleton" procedure and the "building" technique be further developed for handling displays. | C2c |  | A6 |
| .3203 Could keying techniques be developed for different types of displays and for different purposes. | A2ci C2b,D1b |  | A7 E3b |
| .3204 Should different types of lines be developed for different figures and diagrams or parts of diagrams. | D2 |  |  |
| .3205 What would be the optimum size of books when pictures are deleted and there are only one or two words per page. | B6biii |  |  |
| .3206 What should be done with the various ways of marking answers to tests, exercises, etc. | A3aii(A), (B) |  |  |
| .32061 Where should answers be placed, especially when they appear at the back of books or supplements |  |  | G6d |

TF       MU      M & C

320611   Should they be placed at the end of the
exercises or the volume in which they occur.                    G6di

320612   Should a note accompany the exercises telling
where the answers are located.                           G6dii

4.0  Non-linear displays (Maps, charts, diagrams)

The problems in this area are less related
to codes and line-types of figures and cannot
be tied-in well with these problems. Moreover,
they require more basic kinds of tactual
perceptual research. Hence, they will be treated
intact and separately. The specific problems
of this area can be found in the section dealing
with the outcomes of the area committee meetings
attached to this report. The ones most relevant
to work on the braille codes are in sections
I, III, IV, VI and some of VII.

5.0  Factors Needing Development.

.1  Complete codes

.10  The development of complete codes are needed for
the following areas: Astronomy, Biology,
Botany, Chemistry, Computer, Physics, Logic,
Medicine, Statistics and Zoology.          VIa1,B1        VB2

.101  Should those codes which are nearly completed,
viz. Chemistry and Computer, be evaluated for
their notation, format, and rules.                         B1

.102  To what extent should codes be developed for
the manifold areas of study - numerous new
fields of study and endeavor are continuously
unfolding. Could some conditions or
specifications determine what areas should
be encoded in braille.                                  B3

.2  Symbology, Format, and Rules.

.20  Symbology and rules need to be developed for
Linguistics, different code systems, e.g.
Morse and semophore, cooking, and different
handicarafts, e.g. sewing, knitting, weaving,
etc.                                               D1,G1
                                                       H2,I

.21  Formating procedures and rules need to be
developed for recipes in cooking, and certain
of the handicrafts. Should these formats be
standardized.                                    VIH1,I

.3  Displays.

.30 Procedures and rules for linear displays need to
be developed for the areas of Money and Commerce
and different types of puzzles and games.                      E1,G2

.31 Procedures and rules for non-linear displays need
to be developed for some of the puzzles and games
and the areas of Geography and Geology.                       C1,G2

.4 Special factors needing development.

.40 Biblical reference symbols.

.401 Most of the problems have to do with the vagaries
of numbering found in the different editions of
the Bible and how they should be treated in
braille.                                                       F1

.402 Should a standard numbering system be developed
for all biblical references.                                   F2

.403 Should the biblical reference symbols currently
used be evaluated.                                             F3

.5 Music materials needing development.

.50 There are quite a few items needing development
in the area of braille music. They come under
two categories - (1) development of different
types of music and materials, and (2) develop-
ments for different instruments. They are
listed in the results of the Music Committee
Meeting, and will not be repeated here.                        IVB,C

6.0 Resources
Persons, organizations, and materials which
would be useful in resolving the
aforementioned problems are listed at the
back of the reports for each of the separate
committee meetings. Foremost among persons
competent to deal with problems of the codes
are those who served as active committee
members in each of the areas. These
sources will not be repeated in this section.

## Appendix E

### Two Reviewers' Judgments of Methodology* and Time

### for Resolving the Generalized Problem Items.

|  | A | B |  |  | A | B |
|---|---|---|---|---|---|---|
|  |  |  | .131 | CD,2 | GJ,LA,1 |
| 1.0 General Considerations |  |  | .132 | CD,1 | GJ,1 |
|  |  |  | .133 | GJ,2 | GJ,1 |
| .111 | GJ,1 | GJ,1 | .1331 | GJ,2 | GJ,2 |
| .1111 | GJ,1 | GJ,OS,1 | .1332 | GJ,2 | GJ,2 |
| .1112 | GJ,1 | GJ,1 | .134 | GJ,2 | GJ,1 |
| .1113 | GJ,1 | GJ,1 | .135 | ER,2 | GJ,ER,2 |
| .112 | GJ,1 | GJ,1 | .1351 | ER,2 | GJ,ER,2 |
| .113 | GJ,1 | GJ,1 | .1352 | ER,1 | GJ,LA,1 |
| .114 | ER,1 | GJ,ER,1 | .1353 | GJ,1 | GJ,1 |
| .121 | ER,2 | ER,2 | .136 | GJ,1 | GJ,ER,1 |
| .1211 | ER,2 | ER,2 | .137 | CD,2 | CD,2 |
| .1212 | ER,2 | ER,2 | .138 | CD,2 | CD,2 |
| .1213 | ER,2 | ER,2 |  |  |  |
| .122 | ER,2 | ER,2 | .141 | GJ,1 | GJ,1 |
| .1221 | ER,2 | ER,2 | .142 | GJ,1 | GJ,1 |
| .1222 | ER,2 | ER,2 | .1421 | GJ,1 | GJ,OS,1 |
| 123 | CD,2 | GJ,2 | .1422 | GJ,1 | GJ,OS,1 |
| .124 | CD,2 | GJ,LA,2 | .1423 | GJ,1 | GJ,1 |
| .125 | CD,2 | GJ,1 | .143 | ER,2 | GJ,ER,1 |
| .126 | CD,2 | GJ,1 |  |  |  |
| .127 | CD,2 | GJ,2 |  |  |  |

* The evaluation consisted of three basic methodologies, GJ - Group Judgment or Consensus, ER - Experimental or Empirical Research, and CD - Code Development, and two time estimates, (1) Short term activity of less than three years, and (2) long term efforts requiring more than three years. Reviewer B, while using the three basic approaches, attempted to elaborate the evaluation by combining the methods and adding two others. LA - Literature Analysis, which can be a review or analysis of the braille and/or print literature or a frequency count of elements of the language, and OS - an Opinion Survey. This latter evaluation will be used for subsequent tabulations.

|  | A | B |  |  | A | B |
|---|---|---|---|---|---|---|
| .151 | GJ,1 | GJ,1 |  | .191323 | CD,2 | GJ,1 |
| .152 | GJ,1 | GJ,1 |  | .191324 | ER,2 | GJ,ER,2 |
| .1521 | GJ,1 | GJ,1 |  | .1914 | ER,2 | GJ,ER,1 |
| .1522 | ER,1 | GJ,LA,1 |  | .1915 | GJ,1 | GJ,1 |
| .1523 | GJ,1 | GJ,1 |  |  |  |  |
| .153 | GJ,2 | GJ,2 |  | .1921 | ER,2 | GJ,ER,2 |
| .1531 | ER,2 | ER,2 |  | .1922 | GJ,1 | GJ,OS,1 |
| .1532 | GJ,2 | ER,2 |  | .1923 | ER,2 | GJ,ER,2 |
| .1533 | GJ,1 | ER,2 |  | .1924 | ER,2 | GJ,ER,2 |
| .1534 | GJ,1 | GJ,1 |  | .1925 | ER,2 | ER,2 |
| .154 | GJ,1 | GJ,OS,1 |  | .1926 | ER,1 | GJ,1 |
|  |  |  |  |  |  |  |
| .161 | CD,2 | GJ,1 |  | .211 | GJ,1 | GJ,1 |
| .162 | CD,2 | GJ,1 |  | .221 | GJ,1 | GJ,1 |
| .163 | CD,2 | GJ,CD,1 |  | .2211 | ER,2 | GJ,ER,1 |
| .164 | GJ,2 | GJ,1 |  | .2212 | ER,GJ,2 | GJ,ER,2 |
| .1641 | GJ,2 | GJ,1 |  | .222 | CD,1 | GJ,1 |
| .16411 | GJ,2 | GJ,1 |  | .223 | GJ,1 | GJ,1 |
| .16412 | GJ,2 | GJ,1 |  | .224 | GJ,1 | GJ,1 |
| .1642 | GJ,1 | GJ,1 |  |  |  |  |
| .1643 | GJ,2 | GJ,LA,1 |  | .231 | GJ,1 | GJ,ER,1 |
| .1644 | GJ,2 | GJ,1 |  | .232 | GJ,1 | GJ,1 |
|  |  |  |  | .233 | GJ,1 | GJ,1 |
| .171 | GJ,1 | GJ,LA,1 |  | .2331 | GJ,1 | GJ,1 |
| .1711 | GJ,1 | GJ,1 |  | .2332 | ER,1 | GJ,ER,1 |
| .1712 | ER,1 | GJ,LA,1 |  | .23321 | GJ,1 | GJ,ER,1 |
| .1713 | GJ,1 | GJ,OS,1 |  | .23322 | GJ,1 | GJ,1 |
| .172 | GJ,1 | GJ,LA,1 |  | .234 | GJ,1 | GJ,1 |
| .173 | GJ,2 | GJ,ER,2 |  | .2341 | ER,1 | GJ,ER,1 |
| .174 | GJ,1 | GJ,LA,OS,1 |  | .2342 | GJ,1 | GJ,1 |
|  |  |  |  | .235 | CD,2 | GJ,1 |
| .18 | GJ,2 | GJ,2 |  | .236 | CD,2 | GJ,1 |
| .181 | GJ,1 | GJ,1 |  |  |  |  |
| .1811 | GJ,1 | GJ,1 |  | .241 | CD,2 | GJ,CD,1 |
| 1812 | GJ,1 | GJ,2 |  | .242 | CD,2 | GJ,CD,1 |
| 1813 | GJ,1 | GJ,1 |  | .243 | CD,2 | GJ,1 |
| .1814 | GJ,2 | GJ,2 |  | .244 | GJ,2 | GJ,1 |
| .182 | CD,2 | CD,2 |  | .245 | GJ,2 | GJ,1 |
| .183 | CD,1 | GJ,1 |  | .2451 | GJ,2 | GJ,LA,1 |
|  |  |  |  | .2452 | GJ,1 | GJ,1 |
| .1911 | CD,2 | GJ,1 |  | .2453 | GJ,1 | GJ,1 |
| .19111 | CD,2 | GJ,1 |  | .246 | CD,2 | GJ,LA,1 |
| .19112 | CD,2 | GJ,1 |  |  |  |  |
| .1912 | CD,2 | CD,2 |  | .251 | ER,2 | GJ,ER,2 |
| .1913 | CD,2 | GJ,CD,2 |  | .252 | GJ,1 | GJ,1 |
| .19131 | CD,2 | GJ,1 |  | .253 | GJ,1 | GJ,ER,2 |
| .19132 | CD,2 | GJ,1 |  | .254 | ER,2 | ER,2 |
| .191321 | CD,2 | GJ,1 |  |  |  |  |
| .191322 | CD,2 | GJ,1 |  |  |  |  |

| | A | B |
|---|---|---|
| **2 0** | **Problems of Symbols and Rules** | |
| 1 | GJ,2 | GJ,LA,2 |
| 11 | GJ,2 | GJ,LA,1 |
| 12 | GJ,2 | GJ,1 |
| 13 | GJ,2 | GJ,1 |
| 14 | ER,1 | GJ,ER,1 |
| 15 | GJ,1 | GJ,1 |
| 16 | GJ,1 | GJ,LA,1 |
| 17 | GJ,1 | GJ,1 |
| 18 | GJ,1 | GJ,1 |
| 19 | CD,2 | GJ,ER,1 |
| 20 | CD,2 | GJ,1 |
| 21 | CD,2 | GJ,1 |
| 22 | CD,2 | GJ,1 |
| 23 | ER,2 | ER,2 |
| 24 | GJ,1 | GJ,LA,1 |
| 25 | GJ,1 | GJ,OS,1 |
| 26 | GJ,1 | GJ,1 |
| 27 | ER,2 | GJ,ER,2 |
| 3 | CD,2 | GJ,1 |
| 31 | GJ,1 | GJ,1 |
| 32 | GJ,1 | GJ,1 |
| 33 | GJ,1 | GJ,1 |
| 34 | GJ,1 | GJ,LA,1 |
| 35 | ER,1 | GJ,LA,1 |
| 4 | GJ,2 | GJ,ER,2 |
| 41 | ER,2 | ER,2 |
| 42 | GJ,2 | GJ,1 |
| 43 | GJ,2 | GJ,1 |
| 44 | GJ,1 | GJ,ER,1 |
| 45 | ER,2 | GJ,ER,1 |
| 46 | ER,2 | GJ,ER,1 |
| 47 | ER,2 | GJ,ER,1 |
| 5 | CD,2 | GJ,CD,1 |
| 51 | CD,1 | GJ,ER,1 |
| 52 | GJ,1 | GJ,1 |
| 53 | GJ,1 | GJ,1 |
| **3 0** | **Formats and Linear Displays** | |
| 1 | Formats | |
| 1111 | GJ,ER,1 | GJ,ER,1 |
| 1112 | ER,1 | ER,1 |
| 1113 | GJ,1 | GJ,1 |
| 1114 | GJ,1 | GJ,1 |
| 1121 | GJ,ER,1 | GJ,ER,OS,1 |
| 1122 | GJ,1 | GJ,1 |

| | A | B |
|---|---|---|
| 1131 | ER,1 | ER,OS,1 |
| 1132 | GJ,1 | GJ,ER,OS,1 |
| 1133 | GJ,1 | GJ,ER,1 |
| 1134 | ER,1 | ER,OS,1 |
| 1135 | GJ,1 | GJ,1 |
| 1141 | GJ,ER,1 | GJ,OS,1 |
| 11411 | GJ,1 | GJ,1 |
| 11412 | GJ,1 | GJ,LA,1 |
| 11413 | GJ,1 | GJ,1 |
| 11414 | GJ,1 | GJ,1 |
| 1151 | GJ,1 | GJ,OS,1 |
| 1211 | GJ,1 | GJ,ER,OS,1 |
| 12111 | GJ,1 | GJ,LA,1 |
| 12112 | ER,1 | ER,1 |
| 12113 | GJ,1 | ER,OS,1 |
| 12114 | GJ,1 | ER,OS,1 |
| 12115 | GJ,1 | GJ,OS,1 |
| 1221 | GJ,ER,1 | GJ,ER,1 |
| 1222 | GJ,1 | GJ,ER,1 |
| 1223 | GJ,1 | GJ,1 |
| 1224 | GJ,1 | GJ,1 |
| 1225 | GJ,2 | GJ,LA,1 |
| 1226 | GJ,2 | GJ,1 |
| 1231 | GJ,1 | GJ,ER,1 |
| 1232 | GJ,1 | GJ,1 |
| 1233 | GJ,1 | GJ,1 |
| 1241 | GJ,1 | GJ,ER,1 |
| 1242 | GJ,1 | ER,LA,1 |
| 1243 | GJ,1 | GJ,ER,1 |
| 1244 | GJ,1 | ER,OS,1 |
| 1245 | GJ,1 | GJ,ER,1 |
| 1246 | GJ,1 | GJ,LA,1 |
| 1247 | ER,1 | ER,1 |
| 1248 | GJ,1 | GJ,LA,1 |
| 1251 | GJ,1 | GJ,ER,LA,1 |
| 1252 | GJ,ER,2 | GJ,LA,1 |
| 1253 | GJ,ER,2 | GJ,LA,1 |
| 1254 | GJ,1 | GJ,1 |
| 1255 | GJ,1 | GJ,ER,1 |
| 1256 | ER,1 | ER,LA,1 |
| 1257 | GJ,1 | GJ,ER,1 |
| 1258 | GJ,ER,2 | GJ,ER,1 |
| 1261 | GJ,1 | GJ,1 |
| 1262 | GJ,ER,1 | GJ,LA,1 |

| | A | B | | A | B |
|---|---|---|---|---|---|
| .1263 | ER,1 | ER,OS,1 | .12963 | GJ,1 | GJ,LA,1 |
| .1264 | GJ,ER,1 | ER,1 | .1297 | GJ,1 | GJ,1 |
| .1265 | GJ,1 | GJ,ER,LA,1 | .12971 | GJ,1 | GJ,ER,1 |
| | | | .12972 | GJ,1 | GJ,1 |
| .1271 | GJ,1 | GJ,LA,1 | .12973 | GJ,1 | GJ,LA,1 |
| .1272 | GJ,1 | GJ,1 | .12974 | GJ,1 | GJ,LA,1 |
| .1273 | GJ,1 | GJ,ER,1 | .12975 | GJ,1 | GJ,LA,1 |
| .1274 | GJ,1 | GJ,LA,1 | | | |
| .1275 | GJ,1 | GJ,ER,1 | .12981 | GJ,CD,1 | GJ,ER,LA,1 |
| .12751 | GJ,1 | GJ,ER,OS,1 | .12982 | GJ,1 | GJ,ER,1 |
| .12752 | GJ,1 | GJ,LA,1 | .12983 | CD,2 | GJ,ER,1 |
| .12753 | GJ,1 | GJ,LA,1 | .129831 | ER,1 | GJ,ER,1 |
| .1276 | GJ,1 | GJ,1 | .129832 | CD,2 | GJ,1 |
| .1277 | GJ,1 | GJ,1 | | | |
| .12771 | ER,1 | GJ,1 | .1311 | GJ,1 | GJ,1 |
| .12772 | GJ,1 | GJ,1 | .1312 | GJ,1 | GJ,1 |
| .1278 | GJ,1 | GJ,1 | .13121 | ER,1 | ER,1 |
| .1279 | GJ,1 | GJ,LA,1 | .13122 | ER,1 | GJ,ER,1 |
| | | | .13123 | GJ,1 | GJ,1 |
| .1281 | GJ,1 | GJ,ER,LA,1 | .1313 | GJ,1 | GJ,1 |
| .1282 | GJ,1 | GJ,1 | .13131 | GJ,1 | GJ,1 |
| .1283 | GJ,1 | GJ,ER,1 | .13132 | GJ,1 | GJ,1 |
| .1284 | CD,1 | GJ,1 | .13133 | GJ,1 | GJ,LA,1 |
| .1285 | GJ,1 | GJ,LA,1 | .13134 | CD,1 | GJ,1 |
| .1286 | GJ,1 | GJ,ER,1 | .131341 | CD,1 | GJ,1 |
| | | | .131342 | GJ,1 | GJ,1 |
| .1291 | GJ,ER,2 | GJ,LA,1 | .131343 | GJ,1 | GJ,1 |
| .12911 | GJ,1 | GJ,1 | | | |
| .12912 | GJ,1 | GJ,OS,1 | .1321 | GJ,1 | GJ,LA,1 |
| .1292 | CD,2 | GJ,LA,1 | .1322 | GJ,1 | GJ,ER,1 |
| .12921 | CD,2 | GJ,1 | .13221 | GJ,1 | GJ,LA,ER,1 |
| .12922 | GJ,CD,2 | GJ,ER,1 | .13222 | GJ,1 | GJ,ER,LA,1 |
| .12923 | GJ,1 | GJ,1 | .13223 | GJ,1 | GJ,ER,1 |
| .1293 | GJ,1 | GJ,OS,1 | | | |
| .12931 | GJ,1 | GJ,1 | .1331 | GJ,1 | GJ,LA,1 |
| .12932 | GJ,1 | GJ,ER,1 | .13311 | GJ,1 | GJ,LA,1 |
| .12933 | ER,1 | ER,1 | .13312 | GJ,1 | GJ,1 |
| .12934 | GJ,1 | GJ,LA,1 | .13313 | GJ,1 | GJ,1 |
| .12935 | GJ,1 | GJ,1 | | | |
| .12936 | GJ,1 | GJ,1 | .1341 | CD,2 | GJ,LA,1 |
| .1294 | GJ,1 | GJ,1 | .1342 | GJ,1 | GJ,OS,1 |
| .12941 | GJ,1 | GJ,1 | .1343 | GJ,1 | GJ,LA,ER,1 |
| .12942 | GJ,1 | GJ,1 | .1344 | CD,2 | GJ,CD,2 |
| .12943 | ER,1 | GJ,LA,1 | .1345 | CD,2 | GJ,1 |
| .1295 | ER,1 | ER,1 | .1346 | GJ,1 | GJ,1 |
| .12951 | ER,1 | ER,1 | .13461 | GJ,1 | GJ,1 |
| .12952 | ER,1 | ER,1 | .13462 | GJ,1 | GJ,1 |
| .12953 | GJ,1 | GJ,ER,1 | .13463 | GJ,1 | GJ,1 |
| | | | .1347 | GJ,1 | GJ,1 |
| .1296 | GJ,1 | GJ,1 | .13471 | GJ,1 | GJ,LA,1 |
| .12961 | GJ,1 | GJ,1 | | | |
| .12962 | GJ,1 | GJ,ER,1 | | | |

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| | A | B | | | A | B |
|---|---|---|---|---|---|---|
| 13472 | GJ,1 | GJ,1 | | .241 | GJ,1 | GJ,ER,1 |
| 13473 | CD,1 | GJ,1 | | .242 | GJ,1 | GJ,ER,1 |
| 13474 | CD,1 | GJ,1 | | .243 | GJ,1 | GJ,ER,1 |
| .13475 | GJ,1 | GJ,1 | | .244 | GJ,1 | GJ,ER,1 |
| 1348 | GJ,1 | GJ,1 | | | | |
| 1349 | GJ,1 | GJ,1 | | .251 | GJ,1 | GJ,ER,1 |
| .1350 | CD,1 | GJ,1 | | .252 | ER,2 | ER,LA,GJ,1 |
| .1351 | GJ,1 | GJ,1 | | .2521 | GJ,1 | GJ,ER,LA,1 |
| .1352 | GJ,1 | GJ,OS,1 | | .2522 | GJ,1 | GJ,ER,1 |
| 1353 | GJ,1 | GJ,1 | | .253 | ER,2 | ER,2 |
| .1354 | GJ,1 | GJ,1 | | .254 | GJ,1 | GJ,ER,1 |
| | | | | .255 | GJ,1 | GJ,1 |
| 2 Linear Displays | | | | .256 | ER,2 | ER,2 |
| .211 | GJ,ER,2 | GJ,ER,LA,2 | | .2561 | ER,2 | ER,2 |
| .212 | ER,2 | ER,OS,1 | | .2562 | ER,2 | ER,GJ,2 |
| .213 | GJ,2 | GJ,LA,1 | | .257 | GJ,1 | GJ,1 |
| .2131 | ER,2 | ER,2 | | | | |
| .2132 | ER,1 | ER,1 | | .261 | GJ,1 | GJ,ER,1 |
| .2133 | GJ,ER,1 | GJ,LA,1 | | .262 | ER,1 | ER,1 |
| .2134 | GJ,1 | GJ,1 | | .263 | GJ,1 | GJ,ER,1 |
| .214 | GJ,1 | GJ,ER,1 | | .264 | ER,1 | ER,1 |
| .2141 | ER,2 | GJ,ER,LA,2 | | | | |
| .2142 | ER,1 | ER,1 | | .271 | GJ,1 | GJ,ER,1 |
| .215 | GJ,2 | GJ,LA,2 | | .2711 | GJ,1 | GJ,LA,ER,1 |
| .216 | GJ,2 | GJ,2 | | .2712 | GJ,1 | GJ,ER,1 |
| .2161 | GJ,1 | GJ,1 | | .2713 | GJ,1 | GJ,ER,1 |
| .2162 | GJ,1 | GJ,LA,1 | | .27131 | GJ,1 | GJ,1 |
| .217 | GJ,ER,2 | GJ,ER,2 | | .27132 | GJ,1 | GJ,1 |
| | | | | 27133 | GJ,1 | GJ,ER,1 |
| .221 | GJ,1 | GJ,LA,1 | | .272 | GJ,1 | GJ,ER,1 |
| .222 | ER,2 | ER,LA,1 | | | | |
| .223 | ER,2 | ER,2 | | .281 | ER,1 | ER,GJ,1 |
| .2231 | GJ,ER,1 | GJ,ER,1 | | .282 | GJ,1 | GJ,ER,1 |
| .2232 | GJ,1 | GJ,ER,1 | | .283 | GJ,1 | GJ,ER,1 |
| .2233 | GJ,1 | GJ,ER,1 | | .284 | ER,1 | GJ,ER,1 |
| .2234 | GJ,1 | GJ,ER,1 | | | | |
| .224 | ER,2 | GJ,ER,LA,2 | | .291 | GJ,1 | GJ,ER,1 |
| | | | | .2911 | GJ,1 | LA,ER,1. |
| .231 | ER,2 | GJ,ER,1 | | .2912 | GJ,1 | GJ,1 |
| .232 | GJ,1 | GJ,ER,LA,1 | | .2913 | GJ,1 | GJ,1 |
| .2321 | GJ,1 | GJ,ER,1 | | .292 | GJ,1 | GJ,ER,1 |
| .2322 | GJ,2 | GJ,ER,1 | | .293 | GJ,1 | ER,1 |
| .2323 | GJ,2 | GJ,ER,1 | | .294 | GJ,ER,1 | ER,1 |
| .2324 | ER,2 | GJ,ER,2 | | .295 | GJ,1 | GJ,ER,1 |
| .233 | GJ,1 | GJ,OS,LA,1 | | .2951 | GJ,1 | GJ,ER,1 |
| .234 | GJ,1 | GJ,1 | | .2952 | GJ,1 | GJ,1 |
| .2341 | GJ,1 | GJ,1 | | .2953 | GJ,1 | GJ,1 |
| .2342 | GJ,1 | GJ,LA,1 | | | | |
| .2343 | GJ,1 | GJ,1 | | | | |

|  | A | B |  |  |  | B |
|---|---|---|---|---|---|---|
| .3001 | GJ,1 | GJ,ER,1 | 5 | Music |  |  |
| .3002 | GJ,1 | GJ,1 |  |  |  |  |
|  |  |  | IV A | 1 |  | GJ,1 |
| .3101 | GJ,1 | GJ,ER,1 |  | 2 |  | GJ,1 |
| .31011 | GJ,1 | GJ,ER,1 |  | 3 |  | ER,1 |
| .31012 | GJ,1 | GJ,ER,LA,1 |  | 4a |  | GJ,1 |
| .31013 | GJ,1 | GJ,ER,1 |  | b |  | GJ,1 |
| .310131 | GJ,1 | GJ,ER,1 |  | c |  | GJ,OS,1 |
| .310132 | ER,1 | ER,1 |  | 5 |  | GJ,1 |
| .3102 | GJ,1 | GJ,ER,1 | B | 1 |  | GJ,1 |
| .31021 | ER,1 | ER,LA,1 |  | 2a |  | GJ,CD,1 |
| .31022 | GJ,1 | GJ,1 |  | b |  | GJ,1 |
| .3103 | GJ,1 | GJ,ER,1 |  | c |  | GJ,1 |
|  |  |  |  | 3a |  | GJ,CD,1 |
| .3201 | GJ,1 | GJ,ER,OS,1 |  | b |  | GJ,1 |
| .32011 | GJ,1 | GJ,ER,1 |  | c |  | GJ,CD,1 |
| .32012 | GJ,2 | GJ,ER,1 |  | d |  | GJ,1 |
| .3202 | GJ,2 | GJ,ER,1 |  | e |  | GJ,1 |
| .3203 | GJ,2 | GJ,ER,LA,1 |  | f |  | GJ,1 |
| .3204 | GJ,ER,2 | GJ,ER,LA,1 |  | g |  | GJ,1 |
| .3205 | GJ,ER,1 | GJ,OS,1 |  | 4a&b |  | GJ,CD,1 |
| .3206 | GJ,ER,1 | GJ,ER,1 |  | 5 |  | GJ,1 |
| .32061 | GJ,1 | GJ,1 |  | 6a |  | GJ,1 |
| .320611 | GJ,1 | GJ,1 |  | b |  | GJ,1 |
| .320612 | GJ,1 | GJ,1 |  | c |  | GJ,1 |
|  |  |  |  | d |  | GJ,1 |
| 5.0 Factors Needing Development |  |  |  | 7a |  | ER,1 |
|  |  |  |  | b |  | GJ,1 |
| .10 | CD,2 | CD,2 |  | 8a |  | GJ,1 |
| .101 | GJ,1 | GJ,ER,CD,1 |  | b |  | ER,1 |
| .102 | GJ,2 | GJ,1 |  | 10a |  | GJ,1 |
| .20 | CD,2 | CD,GJ,LA,2 |  | b |  | GJ,1 |
| .21 | GJ,1 | GJ,1 |  | c |  | GJ,1 |
| .30 | GJ,2 | GJ,ER,2 |  |  |  |  |
| .31 | GJ,2 | GJ,ER,2 |  |  |  |  |
| .401 | GJ,2 | GJ,1 |  |  |  |  |
| 402 | GJ,1 | GJ,1 |  |  |  |  |
| .403 | GJ,1 | GJ,ER,1 |  |  |  |  |